PRACTICAL
MODERN METALITHOGRAPHY

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BEING A COMPLETE, PRACTICAL, AND TECHNICAL HANDBOOK FOR LITHOGRAPHIC PRINTERS, ARTISTS, DESIGNERS, PHOTO-PROCESS WORKERS, AND TECHNICAL STUDENTS, OF THE LATEST AND BEST EUROPEAN AND AMERICAN PRINTING METHODS FROM ZINC AND ALUMINIUM PLATES AND TUBES IN THE LITHOGRAPHIC MANNER

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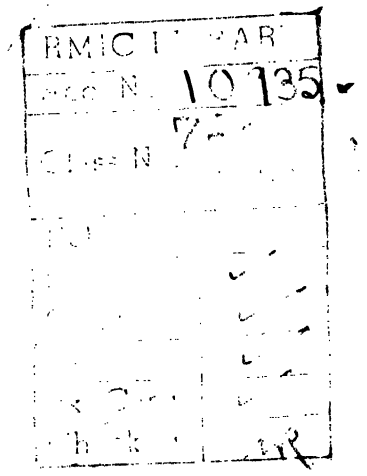
PUBLISHED BY
GARDEN CITY PRESS LTD.
LETCHWORTH, HERTS
1914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PREFACE

OWING to the remarkably rapid development and growth of the *metal plate printing methods* of modern lithography, there has arisen a great need for a thoroughly practical, comprehensive, and up-to-date craft text-book—one which will clearly and unreservedly impart full and reliable instruction and information upon the latest metalithographic printing methods, and likewise serve as a *technical guide* for both the craftsman and the employer, and all others interested in, or identified with, these planographic printing methods.

My aim in this work has been to present and explain every essential and important phase of the art, in as lucid and concise a manner as I could command; and to include the best trade recipes, formulæ, and practical wrinkles appertaining to each section of the industry.

I originally wrote a large portion of this work for the American trade journal, *The National Lithographer*, and this was subsequently reprinted in book form by the "Employing Printers' Association of the United States," for circulation amongst their workpeople.

Through the courtesy of Mr. Warren C. Browne, the editor and publisher of *The National Lithographer*, much of that matter is here reprinted and still further extended and amplified. Additional chapters have been added embracing the latest processes evolved in the craft.

For the first time in any English lithographic text-book a number of actual practical coloured specimens, representative of the latest and most important processes of the trade, have been introduced, and these assist considerably in the applied interest of the text.

Some few years ago I had the honour of being commissioned by a large London firm of lithographers to

write the first published text-book of metalithography in this country, and since that time many important developments have transpired in the craft, which are fully dealt with in this book.

Having myself graduated through the various progressive positions of the craft as journeyman, foreman, manager, and technical expert, I have endeavoured to include useful and practical pointers for each of these departments.

If this present work should meet with the kind reception which my previous writings have obtained, and should prove as useful to those struggling to succeed in their craft—which is admittedly one of the most beautiful, yet one of the most worrying amongst the art-crafts of the day—I shall feel amply repaid for the time and labour which the writing of it has entailed upon me.

JOSEPH GOODMAN.

LETCHWORTH (GARDEN CITY), HERTS.
December 18th, 1913.

INTRODUCTION.

MODERN PRINTING METHODS FROM ZINC AND ALUMINIUM PLATES IN THE LITHOGRAPHIC MANNER.

WE are all familiar with the common axiom so frequently quoted in everyday life, and almost as frequently realised, which never tires assuring us, that "History constantly repeats itself." This curt aphorism, which has verified itself so much in regard to "nations," may also have its parallel applied to the life history of "trades" and "crafts."

Just as the human race has passed through its rude and crude *stone age* of the dim and distant past, on to the present vitalising *metallic epoch* of mankind, so likewise has the craft of lithography traversed through its *cumbrous quarry period* of the unwieldy litho stone and wooden press, on to that of the modern, mighty, power-driven *metalithographic rotary machines* of to-day, with their metallic printing surfaces of zinc and aluminium plates, now fast usurping the old-time stone for universal productive printing purposes.

It is no secret that zinc was the pioneer plate that ventured earliest into the field of competition with the lithographic slab, and it is equally certain that it was the last to securely establish its superiority over all other competing metallic elements, or their alloys, in its undisputed value and service to the present-day lithographer.

But all this only serves to prove that the fittest will triumph in the end, even though it has to pass through

many exasperating vicissitudes and chequered experiences in its transit to the coveted goal; yet that it has now virtually "arrived," is being universally recognised and accepted.

At the same time, we do not wish it to be inferred that we condemn aluminium, as this metal is still preferred by many firms throughout the world for a large volume of lithographic work.

It may not be amiss if we hark back again momentarily to one of those past reminiscences of some twenty-five years anon, when our collective conception and practical knowledge of zinc as a printing surface in lithography was quite on different lines to that which prevails to-day. To that period when the unconquered troubles attendant upon zinc fell upon the unlucky printer "as fast and as thick as snowflakes in a blizzard," and to when he was accustomed to breathe those terrifying curses (raked up from the profoundest depths of his second nature) upon the perfidious metal as he "bent his back and bowed his head" over the "wrecked" ink image which had so ruffled his temper and blasted his craft confidence and skilful reputation.

Well do we remember the merriment caused by one witty lithog-Irishman travailing beside us on some troublesome plate, when he confidentially assured us that "he always commenced to curse zinc early in the morning as he was putting on his trousers, and that he never ceased execrating it during the day at his work, and continued the malediction of it in the leisure of his evening as he blew the froth off his pot of four ale"; he said its nature was so bad that it had to be spelt with a letter right deep down at the bottom of the alphabet; and if he had his way, he would consign the "bally" metal itself to as deep a territory assigned to wicked humanity as that which the letter *Z* occupied in the alphabet.

This refers to the period when ponderous slabs of zinc were used as the printing surface—generally half an inch thick—and which were fully impregnated with impurities of other metals and dross. We also at that

time tried to print from them with an almost smooth surface, such as was customary with the long-established litho. stone.

Moreover, we then made the culpable error of following out in the etching of the zinc plate the *corrosive principle* as used in the etching of the stone.

We also failed to supplement the *solid* fatty image substances as represented by the transfer ink on the plate, by supplanting them with those of a more penetrative and decidedly liquid nature, as is now attained by the use of the *fluid, greasy, asphaltum tincture washouts*, now in vogue everywhere for metalithography.

The trade did not then seem to contemplate the possibility of enlisting revolutionary methods of etching treatment as now evolved, wherein electrical as well as chemical action was generated in the so-called etching operations—which afford the most perfect results.

In those days the plate *would oxidise* as readily after the etching operation as before it. Now that trouble is eliminated where these non-corrosive etchers are employed.

In order to better comprehend and apportion the relative conditions that prevail in these two distinct methods of modern lithography we must first briefly allude to the underlying principles that dominate lithographic printing from stone; which thus affords the co-relative cue for the zinc.

Here on stone we speedily recognise that two entirely different physical and chemical conditions have to be attained in order to produce a printing image, and which must remain undisturbedly maintained on its surface during the actual printing operations. The one is a *fatty compound*, produced and preserved by means of the grease-laden ink of the design. Here the fatty acids contained in the transfer inks, possessing a chemical affinity for the lime base of which the stone is comprised, form with it a grease-attracting and grease-retaining allegiance, and consequently a water-resisting one.

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We have now to account for the other remaining plain portions of the stone surface—those upon which ink must not adhere; these also need definite chemical treatment; in this case with a free acid (nitric solution), which decomposes them, producing at the same time physical changes, first by making these plain places of a "rough," "matt," and "granular" character; which condition not only serves the purposes of *miniature reservoirs* for the retention of the essential damping water, but also affords a "grip-hold" for the inking rollers, when passing over the stone; and thus more effectually prevents them skidding and sliding over the face of the work.

At the same time, the decomposition of these parts by the acid solution produces a nitrate of lime compound in place of the carbonate of lime, and has the additional effect of raising the work slightly into relief.

But this is not all, as we have not here yet obtained the full requisite chemical conditions indispensable for these plain parts to acquire; this can only be done by what is known as the "*gumming operation*," in which we apply to them a syrupy solution of "gum-arabic"; which, on its drying and oxidising with these uninked portions of the stone, forms there that important and necessary compound known as "gummate of calcium," a compound entirely different in character and condition to that possessed by the "fatty calcium compound," being, in fact, the direct antithesis to it and none the less ignorable, as it *desensitises* those plain parts to grease.

Here, then, in the lithographic stone as a printing medium we have a natural substance, upon which we can *produce two contrary conditions*—one whose natural attributes are an "affinity" or "liking for water" (which is supplied in the damping operations), and which affords those portions the "power to reject grease"; in the other we can create a "grease-attracting" and "water-rejecting" condition; both of these peculiar qualities being absolutely essential to

" planographic," or " flat surface printing," as represented by the lithographic process.

If either of these two adverse conditions should be faulty, then perfect printing cannot be effected; as, for example—assuming that the image has been perfectly drawn upon the stone—if the " lights " become soiled through an inefficient etching, or gummate; then the actual print itself becomes degraded.

Equally so, then, is the *same range of resultant, opposite conditions vital*, in the METALITHOGRAPHIC PROCESS, or flat surface printing in the lithographic manner from metal plates, such as zinc or aluminium.

Commencing first then with zinc: here we find that this metal also possesses (like the litho stone) a strong affinity for fatty bodies; hence greasy transfer inks combine readily with it. In fact, it is even more sensitive and susceptible to grease than what the stone is, so far as superficial relations are involved; but at the same time it does not inherit similar internal penetrative facilities as does the stone, on account of the difference existing in their respective *porosities*, specific *gravities*, and *molecular structure;* the stone, moreover, being a compound body, whilst the zinc is a simple elemental one.

Yet, as we have before intimated, we endeavour to compensate for this in some degree, by applying a supplementary greasy body in a fluid form, in which state it is capable of a more intimate and penetrative action; so that in the end our grease compound on the zinc plate becomes as durably formed as does the similar corresponding compound established upon the stone, notwithstanding the difference in density that prevails in these two bodies.

This, then, is one of the factors that has made for the modern triumph of zinc (and, incidentally, for aluminium also).

But equally important, and what was for long proved to be the most difficult to attain on zinc, is the opposing state—that of the aqueous-bearing portions, or gummate of the metal—where it is incumbent and essential

that those parts shall be fully "de-sensitised" to grease, so as to form and preserve the perfect "lights" of the printing image.

Instead of merely eating those parts slightly away by the agency of a corrosive acid, and leaving soluble compounds behind, as in the case of the old "etching" operations (from the Dutch word "Etzen"—to eat away), we now, in the latest and most perfect methods, apply a solution consisting of a mixture of various chemical compounds, which generate with the metal a *voltaic action*, which, in and through this electrical influence, produces a new surface compound or layer, in direct chemical union with the zinc itself.

This new surface is then the most perfect grease-resisting medium yet devised or secured from a metal surface.

In short, the whole of the plain zinc surface that has come in contact with this fluid has now become transformed from the simple metallic elemental state in which it originally existed, into that of a new compound body, now possessing entirely different physical and chemical attributes, inasmuch as these parts of the zinc surface have now a predominant affinity and preference for water, and an absolute inability to hold grease when moisture is present and applied to them, in contradistinction to that state in which, immediately prior to this treatment, they had absolute preference and susceptibility for.

All this remarkable change of surface is accomplished without any loss in the volume of the metal, even though the so-called etching operation should have been prolonged inordinately. Whereas in the old-time method, when zinc was struggling for a firm place in lithography, a prolonged etching spelt ruin to the finer parts of the work, such as the "hair lines" and "delicate stipple," owing to the undercutting action of the acid creeping under the lines, and thus undermining the fine work.

It may further be affirmed that, with the most perfect etching method now at the service of the metalitho-

grapher, that a prolonged treatment with this non-corrosive etcher is often of an advantageous nature, especially when an excessively greasy quality and brand of ink is being used, as is sometimes the case; here the extra etching operation appears to carry the grease-resistive properties to a lower strata of the metal, and thus render it much longer immune to grease encroachments, should the natural attrition of the plate during working operations have impaired its original upper surface layer.

This, taken in conjunction with the more profluent and wider capacity of the "modern rotary machines," and the "automatically-fed rubber offset machines," has advanced the case for the metal zinc as a printing surface in lithography, not only on a par with the old-time stone, but legions beyond it in productivity, security, economy, and efficiency.

Every class and range of *chromo* and *commercial* work—excepting some forms of ceramic productions—can be done by metalithography, including *direct draughtsmanship*, as well as *transferring* of every description: reverse and transposition work, chalkwork, engraved work, and intaglio etching, embossing, etc.; also photo-lithography in both line and high-light halftone; as well as in irregular grain of the highest attainments, are all now done from metal plates in the lithographic manner.

Although only zinc and aluminium plates or tubes have so far been universally adopted in metalithography, yet other metals such as iron, and alloys of zinc and nickel have also given good planographic printing results in the lithographic manner, when worked in conjunction with suitable etchers adapted to the particular requirements of these metals.

PRACTICAL MODERN METALITHOGRAPHY

CHAPTER I.

VARIOUS GAUGES OF LITHO. ZINC PLATE—BEST SOURCE OF METAL—TREATMENT OF NEW UNPREPARED ZINC SHEETS—PLATE BEND AND PLATE CUTTING—PRINCIPLES OF PLATE GRAINING—BEST GRAINING MATERIALS AND TEXTURE OF GRAIN, COARSE AND FINE.

IT will no doubt prove of great interest to a large circle of our confrères of the craft, if we first describe the *free* methods in use in England and other parts of the British Isles, for printing lithographically from zinc plates, as well as the chief Continental methods, outside of the proprietary processes protected by letters patent.

Commencing, then, with new, plain, uncoated sheets of best Silesian or American zinc, of the purest quality, we select plates from a range of thicknesses registering from 33 to 19 B. W. G. (Birmingham wire gauge) for machine use, both "flat-bed," "direct rotary," and "offset rotary." All of these thicknesses of plate enable them to be bedded down to their supports perfectly "taut," and without "buckling."

For the "hand press," and for "originals," the thinner gauges of plates are employed, usually ones ranging from 29 to 25 B. W. G., being the gauge sizes utilised for press work; whilst for "rubber offset" a thinner plate, for example, 33 B. W. G., is used; equivalent to .008 of an inch designation.

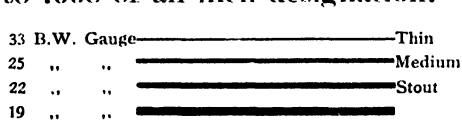


FIG. 1.

Although we here have large deposits of zinc ore located in the Mendip hills in Somersetshire, England, where it has long been extensively mined, yet despite that the bulk of the zinc plates of lithographic commerce for use in the British Isles are imported from abroad, chiefly from Continental sources, Silesia and the United States; until recently the preponderance of them, however, hailed from Silesia. These plates are ordinarily procured through the regular supply houses, and are then generally bought surface grained, ready for immediate use. There are some firms, however, who obtain them in the bare, unprepared state as sent out from the mill, with the hard, scaly outer skin of the metal still adherent upon them, as produced in the rigid rolling operations of manufacture. In this case additional tasks are imposed upon the lithographer, who has to first see to the removal of this outer compression, and to select the best face of the plate for the printing surface proper.

It has been found from experience that one face of the plate is purer and freer from defects than the other. This is due in large measure to tiny specks of iron being taken up during the heated manufacturing process, in which, due to the specific gravity of these two metals being different, the zinc, being the heaviest, will fall to the bottom, while the lighter metal will remain on the top.

If, therefore, the new plate is first tested on both sides in the following manner, the best face is easily detected, and at once reserved for the printing surface. We do this by mixing *one part of commercial nitric acid with ten parts of water*, and then applying some of this over a part of each face of the plate, either by means of a sponge or a pad of cotton wool.

If, as a result of this treatment, one side reveals a number of small black specks and streaks, or dark circle markings, this will be the inferior side of the plate, and should be destined to always form the under side for working; the other side, of course, being the one selected for the actual printing surface.

This chosen surface is then lightly polished over with a flat, smooth block of "snake stone" (water of Ayr stone) in order to remove any dross or shell.

Then next the extreme clamp edges of the plate, both "gripper" and "rear," are bent right over in a lap to the extent of about a quarter of an inch, so as to form a thicker wedge-like edge, which serves to afford an additional grip-hold for the clamps on the plate when locking up, and which is consequently a double security against them slipping, or "dragging out," during both "tightening up" and printing operations. This half-inch of plate taken for bending should be allowed for when ordering from the supply houses.

The correct "bend" of the gripper edges of the plate is next made, some establishments using a special "vice mould" for this purpose, while others simply fix one of the plate edges in the grip-bars of a plate bed, fixed in a flat-bed litho machine, and then by means of a long, smooth batten of wood laid in contact along this edge of the plate (this is then dealt a few smart blows with a wooden mallet), at the same time as the zinc plate is being bent down bodily to the plate bed.

If the fold is not fairly straight, the plates are liable to be unevenly strained, and may thus cockle, or possibly crack, and eventually break off during printing.

This plate-grip bend, when once formed, need never be straightened out again for regraining purposes, if proper provision is made for its protection, as the repeated bending and restraightening of this angle deflect soon causes the metal in this part to crack and break away, which then necessitates the plate being cut down for a smaller size.

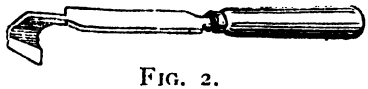


FIG. 2.

The zinc or aluminium sheets may be cut down whenever required, either by hand with a "claw cutter,"

as in Fig. 2, or they may be severed with a treadle cutting machine, as in Fig. 3. This latter is by far the quicker, neater, and better method. They should be so cut that the tension of the pressure in the machine coincides with the direction that they were rolled in at the mill during manufacture. There will then be less liability to strain and fracture.

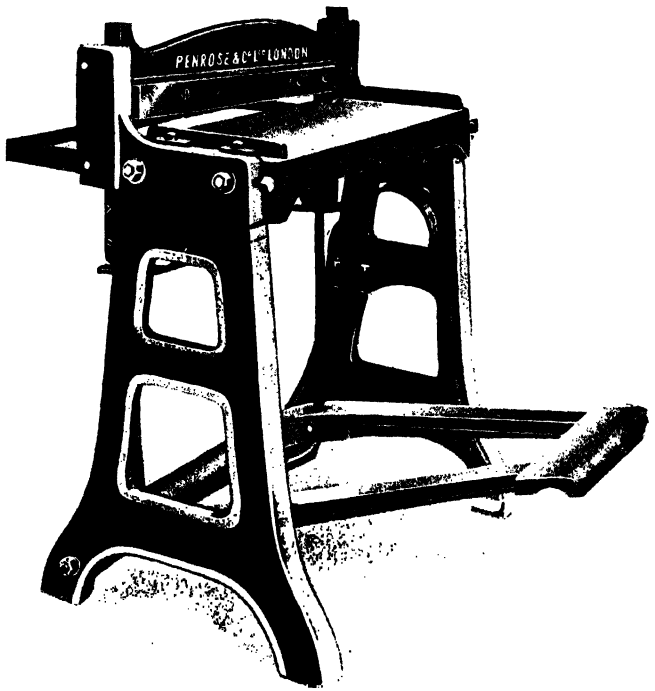


FIG. 3.—TREADLE GUILLOTINE CUTTER FOR ZINC.

Some few old-fashioned firms, however, may still be found who adhere to this injurious practice of rebending the grip edges of the plate each time they have to regrain and retransfer upon them for fresh jobs.

The general run of firms, however, provide bevel-edged wood supports in the bed of the graining machine, and also bevel-edged iron plates for the

transferring presses; so that once the plate is bent at the clamp edges to suit either the flat bed machine or the rotary, there is no need to resort to the re-straightening or flattening out again each time a plate is re-used for a fresh job, as everything is adapted to suit the requirements of the clamp curve during all the necessary phases of manipulation contingent upon the preparation of a plate.

Now, as to the *graining* of the plate. Metalithographic printers soon learn the exceeding importance of this branch of the business, as, if a plate is grained too feebly, then it has not the capacity to retain much moisture upon its surface, and, consequently, will sooner soil with the printing ink; this condition also necessitates a larger volume of damping water being applied to maintain the purity of the "lights"; this naturally reacts upon the brilliance of the ink, "dulling" it, and overloading it with moisture, which reflects itself in the greyness of the print. On the other hand, the transferrer favours a fine, delicate grain, because on this it is easier to roll up the work, as well as to run it down firm and solid, than if the grain of the plate was more "rasping" and "keen."

This perversity of conditions frequently prompts a slight clashing of interests between the "transferring" end of the business and the "machine room" end.

The machine man unhesitatingly urges the more decided graining of the plate, so that the tiny excavations of the grain will form a more perfect reservoir for the retention of the damping water during printing. While the transferrer is partial to the more delicate graining of the plate, so that the "fine lines" of his transfer and his "solids" will be brought under more uniform and accommodating conditions, thus enabling him to send forward an irreproachable transfer with smart expedition.

The most common graining material in use on this side of the Atlantic is a medium texture "pumice powder." This serves for the general run of work. For producing a coarser grain for poster work, "flint

sand" and coarse "glass powder" are both used; whilst "emery powder," fine "glass powder," and "carborundum powder" are each employed for other range and classes of work.

The Ordnance Survey Lithographic Map Printing Department of the R.E., at Southampton, use for the graining of their zinc plates a natural, red-brown, fine sand, found in the region of the New Forest in Hampshire. This is loosened out with a crusher, then sieved through a wire mesh to suit the texture of grain required.

The thick aluminium plates with bevelled edges, as used for other classes of ordnance work, are usually grained with the Sandblast apparatus, in which fine Belgian sand is utilised for the graining.

Hitherto wooden balls were generally employed with the graining machines, but now they are being rapidly displaced by "porcelain" (china) marbles, which are heavier, cheaper, and wear better, not being so prone to form flat sides on them, as is the custom with the maple wood marbles. Another good feature in connection with them is that they do not adhere together in small clusters, as the wooden balls do when "flats" have been worn upon them, as the porcelain marbles wear down in a more rotund manner, instead of angular, as is the drawback with the wooden marbles.

These porcelain marbles (Fig. 4) can be had in different sizes, ranging from three-quarters of an inch in diameter—as used for a fine grain—up to one inch.

FIG. 4.—MARBLES.

Solid glass marbles are used by some grainers, but they are much more expensive, and brittle.

There is also a method of graining plates with dry pumice powder only, using no water whatever during the graining operation; this, however, takes a little

longer time to attain the desired granular matte effect of the plate surface. Yet the grain so attained is preferred by some for certain classes of work.

Whichever method is adopted, the grain can be slightly subdued, if the transferrer, in his judgment, considers it too crisp; this is done by going all over the plate with a felt-covered block and some finer pumice powder, by supplementary hand method for two or three minutes, but we prefer to leave the grain as produced by the machine, although some transferrers consider the plate is not complete till it receives this finishing touch by hand. Plates used to be grained by this hand method (Figs. 5 and 6), but were never very satisfactorily done.

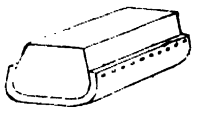


Fig. 5.—Hand-graining Block.

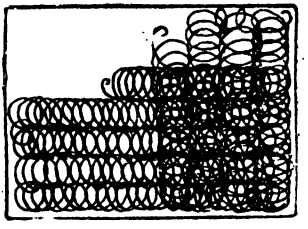


Fig. 6.—Metal Plate, Showing Method of Hand-graining.

If the new zinc plates are purchased from the trade supply houses ready prepared, they can be selected in the texture of grain required. A 160 grain is a useful one for general press work, or for drawing upon; whilst 120 or 100 grain serves for chalkwork or rubbed tint. Some plate manufacturers describe the different surface textures in numerals from 1 to 5. These grains and many others are obtainable upon the Parker plates as supplied by Messrs. Horsell & Co., of Leeds, and also by Algraphy Ltd., of Peckham, London, and Messrs. Penrose & Co., London.

CHAPTER II.

TIER MULTIPLE GRAINING—AFFINITISING OF ZINC PLATES —BATH FORMULAS—TRANSFER PAPERS AND TRANSFER INKS—FORMULA FOR TRANSFER PAPER—TRANSFER PULLING FOR PLATES—ELBAGREEN OIL—SUBSTITUTES —PLATE DRYING METHODS.

An economical Continental "graining" method now being gradually adopted here in Great Britain by the larger lithographic firms is that of using very large-sized "plate graining machines," fitted with a very deep box recess, into which is arranged a number of smaller graining boxes of a much shallower description, being just sufficiently deep to allow each box to carry a plate, and the requisite graining marbles, with a little margin to spare for comfortable working.

These smaller boxes are wedged in tight in tiers in the large box, one above the other, as many as twelve of them being worked at one time, so that in the running of one plate graining machine as many as a dozen plates are being prepared at one and the same time; an important consideration where a number of small litho machines, engaged on "short runs," have to be kept going, or a number of new "originals" required for the transfer department.

After the graining of the plates is properly completed they are well washed back and front, to remove any adhering pumice paste or grains of the powder: they are then treated to an "alum acid bath," which renders them much more sensitive to grease, and also ensures their being made chemically clean.

This treatment is known as the "Affinitising bath," because the function performed by it is to cause the zinc plate to have a greater affinity, or susceptibility, to the greasy ink of the transfer, after having been subjected to its influence in this bathing process.

FIG. 7.—GRAINING BOX.

To carry this operation out "economically" on a large scale a huge upright glazed earthenware tank is employed, fitted with overhanging supports, from which the various plates may be suspended in the bath; or they may be inserted in niched grooves, which are also a separate fitment of this bath.

This bathing is also done on a smaller scale by means of horizontal porcelain dishes; or, in a more economical manner still, by means of wooden troughs, pitch lined, or coated with acid-proof resist varnish, such as "Mogul," or a mixture of shellac and Brunswick Black varnishes (Fig. 8). The constituents of this "affinitising" bath are:

Nitric acid	6 fluid ounces
Powdered alum	½ pound
Water	1 gallon

The alum is best dissolved in warm water, as it is so slowly soluble in cold water.

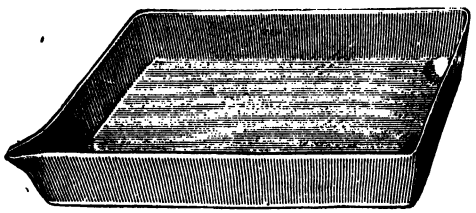
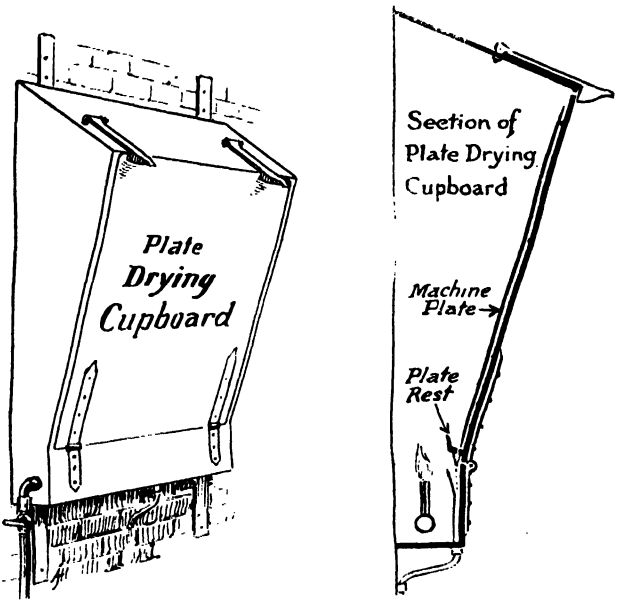


FIG. 8.—BATH.

The zinc plate is immersed in this bath for a period of about five minutes. When the plate is first inserted in this solution a dark-grey deposit quickly forms on its surface; this is sponged off so as to enable the liquor of the bath to again obtain full access to the plate, when eventually it will assume a pleasing silver-grey hue, which is both a nice colour to work upon and a true indication of the best condition which the plate should attain to fit it for the best service in lithography.

After this the plate is washed thoroughly on both sides with a copious supply of perfectly clean water, taking care that no scum of the bath remains upon

its surface : it is then rapidly dried, either over a heater, or in a hot-air chamber (Figs. 9 and 9a), or by means of an electric fan, so as to prevent streak markings or oxidation through slow, faulty drying in a damp, cold, atmosphere. The plate is then ready for either the litho. transferrer, artist, or engraver, and every care must be taken to protect it from greasy finger marks.



FIGS. 9 AND 9A.—PLATE DRYING CHAMBER.

In the transferring to zinc plates, all the usual kinds of transfer papers are employed in their respective applications, just as is done for stone. French transparent transfer paper and Oak Varnish transfer paper are used chiefly for register colour work ; whilst Scotch plate transfer paper is used for copperplate transfers ; the usual Stone-to-stone transfer paper is employed for the zinc plate as for the stone.

A most serviceable variety of this latter paper is that known as the Dresden yellow-coated transfer paper, which is of the ever-damp type.

For transfers from engraved stone a good quality plate transfer paper is used, coated India paper being the best.

For transfer from punched pewter music plates the usual plain, uncoated, spongy paper is used, and furnishes perfect results when properly damped, and a slightly warmed plate is used.

A good Stone-to-Plate transfer paper is made as follows: Take 1 oz. of starch and 1 oz. of flour, and make into about one pint of paste; dissolve one plate of gelatine in hot water, and add to the paste when dissolved. Reheat and boil, then strain. Add about a dessertspoonful of glycerine. Apply two coatings to a 24 lb. demy paper.

The smooth surface Berlin transfer paper is the most useful for taking transfers from halftone blocks. Columbia transfer paper is also esteemed for the same purpose.

Originals should be cleaned up perfectly before commencing to pull transfers from them.

In the matter of transfer ink the same conditions are observed for zinc plates as for stone, with but little exception, as the same transfer inks are used all round for both printing surfaces: the usual method being to mix

two parts of good litho transfer ink with one part of a good litho press black ink for use on zinc plates.

Messrs. Winstone & Sons' transfer inks are very reliable for plates.

This makes the transfer ink in the best condition for work, as it tones down the rawness of the greasy constituents, and at the same time increases the depth of the black colouration, so that the finest hair lines can be more distinctly seen, and the sharpest effect of transfer thus secured.

In connection with these transferring operations there is a trade wrinkle which is not generally known, and which we are pleased to refer to here, so that any who care to put it to the practical test may participate in the advantages that it offers.

It consists of adding to the transfer ink a few drops of a new, oily liquid called "Elbagreen," which has a remarkable effect upon the ink, imparting to it a vitality and vigour that is really surprising.

Transfers that have been pulled with the proper quantity of this oil added will roll up infinitely quicker and more firm than what the best transfer ink affords when used by itself alone; and it is surprising what a small quantity suffices to produce this beneficial effect.

An excess of this oil added makes the transfer ink too mobile, as it were, due to its wonderful diffusive properties. Therefore the transfer puller requires to be precise in the quantity added, as, like the old elements fire and water, they are all "good friends, but very bad masters."

This Elbagreen liquid also possesses and imparts a preservative characteristic, as transfers pulled with ink to which this had been added have gone down to both zinc and aluminium plates virtually perfect, after having been laid aside for six months after pulling, before being used on the plates as transfers. It keeps the ink fresh, and retards its oxidation.

For rolling up work on coarse-grained plates the transferrer may also add a drop or two of it to the "black rolling-up ink," when it will be found to feed the work with a firmer layer of building-up ink, and in a much shorter time, than can be done with the raw ink and varnish alone, as in the old orthodox methods hitherto in vogue.

If this oil is not available, then the next best substitute to use is a mixture of Sperm and Oleic acid oils; only a very small proportion being required, otherwise scumming conditions may arise. Failing these, Chinese wood oil may be used.

Now regarding the volume of ink on the transfer paper, as compared to that required for stone, it is a definite fact that transfers for running down to metal plates should be pulled fuller of ink than what they would be if pulled for use on stone; yet notwithstanding this fact, these transfers will yield a sharper print

from the plate than what can be obtained from the stone. This is one of the valued assets of Metalithography, that infinitely sharper and finer work can be done from the metal printing surface than can be done from the old-time quarry rock printing surface, as represented by the lithographic stone, which gives a more thick and smashed effect in printing than is secured from the plate.

CHAPTER III.

LEVELLING OF PRESS SCRAPER—LEATHER AND METAL TYMPANS—TRANSFERRING PROCEDURE—DAMP BOOK—"LAY-OUTS" AND "KEY-SHEETS"—"SHINING" AND "STICKING-UP" METHODS—BROADWAY PRESS—FLUFFLESS PLATE MOISTENING FABRIC—A VALUABLE TECHNICAL SHINING-UP METHOD—ASPHALTUM WASHING-OUT TINCTURE—ROLLING-UP PROCEDURES.

ASSUMING that the zinc plate has been roughened and prepared in the manner heretofore described, the transferrer then proceeds to carry out the actual transferring operations, the "layout" of the transfers, the "sticking-up," etc., being usually done previously by another member of the transfer staff.

First the "boxwood," or "pear-tree wood" transfer press scraper is levelled up true to plane; this is best done by rubbing its V-shaped edge upon sheets of glass paper (cabinet paper), as it is variously termed: these should be spread across the transferring bed for this rubbing operation, so as to ensure that the two actuating pressure surfaces shall be made parallel and conforming to each other.

If through prolonged hard wear the V-shaped bevel shall have become worn away, or should the scraper have been used very much upon smaller sizes of plates, then a hollow centre will have become worn upon it, making it bow-shaped, or "arched." In these instances it is necessary to first plane the bevel angle on again with a jack plane, and finish off with the glass paper. If a zinc or brass tympan is used, then a leather-faced scraper must be employed.

The zinc plate is then laid upon its support in the transfer press (Fig. 10) (which may be either a special iron bed or a lithographic stone), and having been

carefully dusted on the back so as to free it from any loose fibres or adhering matter, which, if allowed to remain, would indent the plate, and cause an uneveness of surface in those parts; these would appear as small elevated proclivities, and invariably cause undue friction there, which eventually results in "scumming," "tinting," or "catching" during the subsequent repeated and prolonged printing operations.

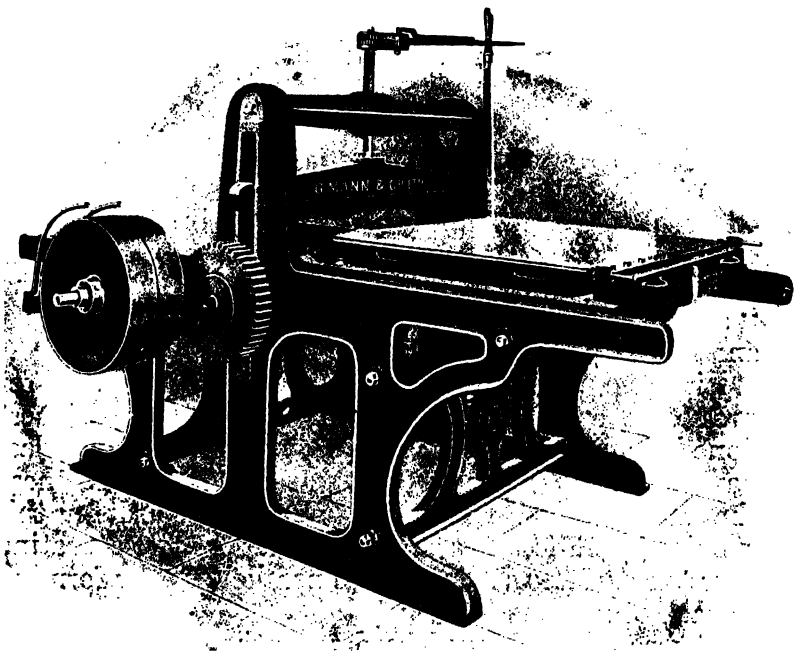


FIG. 10.—BROADWAY TRANSFER PRESS (G. MANN & CO.).

This is inevitable, no matter how completely the etching operation may have been accomplished, as these raised portions have to bear the brunt of undue friction, and thus soon wear smooth, in which condition they can no longer retain an adequate quantity of moisture to protect them from the greasy ink of the rollers.

The surface of the plate support is likewise dusted over with a clean rag for similar reasons.

Further, the printing plate surface itself is always most carefully wiped over before transferring upon it, or "damped," as the case may be, according to the requirements of the different classes of transfer papers that are being used, may dictate.

In this connection of the preliminary "plate dampening operation," it may not be amiss to here point out the important differences that are set up when a plate is dampened with a soft, fluffy cloth, as compared with the same performance when applied to a smooth, polished stone.

The printing plate surface being of a "rough," "matt," "granular" character, causes the soft damp fabric to cling to it when drawn across it, which abrades from off its surface innumerable tiny particles of detached fibres; these become scattered over the face of the plate, often in the form of tiny pellets, which interfere with the perfect transferring of the work to it, causing "broken lines" or tiny, superfluous "lights,"—these being defects requiring "touching up" in the subsequent making-ready operations of the transfer work.

Now, as before alluded to, this peculiarity is not near so apparent or possible when a similar soft fabric is employed for a similar operation in dampening a stone, due to the fact that the smooth polished surface of the stone does not offer the same "tooth" or "rasping abrasion" to the soft material as the roughened metal plate surface does.

It is therefore essential, that in order to produce the best results with a minimum of trouble, a firm material of a fluffless character should be used for this purpose; such substances may be found in the use of a fine smooth chamois leather, or a large, close-textured "cropped" sponge which finds favour with a number of transferrers on this side of the Atlantic. Others again use a fine "corduroy" material.

If, however, a soft fabric should be used for this dampening of the plate, then it must not be wrung out too tightly; in order that a plentiful supply of

moisture may be retained within it, thus being capable of readily imparting to the plate surface the requisite amount of dampness, without the necessity of having to use any great friction in doing so; this will circumvent the difficulty considerably, by reducing the friction.

Then when these requisite provisions are made, and the proper conditions observed and practised, the careful, skilful transferrer is able to secure perfect transferring results from metal plates with the utmost satisfaction and precision, and being much superior to that usually attainable from lithographic stone.

Other classes of transfer paper, such as "Scotch plate" and "Stone-to-stone," as used for general commercial work, may be matured for transferring by insertion in a "damp book"—just as is done for stone. These damp books may be made of either substantial sheets of "soft, sized paper," or sheets of "linen." We prefer a combination of the two, which permits of the linen being periodically re-damped and wrung out, thus keeping the "damp book" in uniform, good condition for each day's work.

For the "making up" of the successive and progressive colour plates in multi-colour (chromo) work here in the British Isles, two different kinds of transfer papers are chiefly used, both of them being of the transparent character. One of these is called the "Oak Varnish paper," and the other one the "French transparent paper." Yet there are exceptions to this rule; we have come across a few firms that use an opaque variety of transfer paper for colour work, "shining-up" for register by means of trimmed corner marks, and the aid of a well-illuminated glass panel cabinet to *shine-up* by.

However, of the two translucent kinds referred to, the one most generally popular is that known as the French transparent tracing transfer paper. This comprises a thin rice-pulp-fibre base, coated with a layer of starch and albuminous composition.

A good adhesive to use in connection with the

"sticking-up" of French transparent transfer paper to dissolve some fine castor sugar in boiling water; when cool, add some red liquid writing ink to colour it. Apply with a small brush. This holds the transfers firm, and dissolves off readily when moistened in transferring. The red colour enables you to see where the adhesive is applied.

The transfer is pulled from the dry plate or stone upon this paper, and is then "shone up" to the *key sheet;* or to an actual printed sheet of the work in progress. This key sheet is usually a specially well rolled and seasoned manilla fibre paper cut from the reel in the "strong-way run" of the fibres—*i.e.*, the direction in which it has received the greatest strain and drag in the paper-making machine—so that it will have this strongest and most resistive direction available for the strain of the transfer press.

Where large-sized sheets are being printed, with very tight registering jobs worked upon them, then the key sheet is usually one securely mounted upon a sheet of zinc, so that it shall be preserved against either contraction or expansion, and afford the most accurate and reliable registering medium for all the colours throughout the transferring operations.

Another method but little known, and consequently but little practised, and yet one which affords many commendable advantages and facilities peculiarly its own, and withal one which we can confidently recommend to those who require a speedy, economic, and "adjustable" method for colour work in progress. Especially and particularly where such chromo work may be undergoing gradual expansion under printing pressure and moisture, as so many classes of modern printing papers are now only too prone to do.

This method consists in first procuring a sheet of thin, yet very strong paper, of the full dimensions of the sheets being printed, and then making it translucent and impervious to moisture by varnishing it over with a penetrative coating of best "pale oak varnish," thinned down with turpentine. This should be done

on both sides of the paper equally, to obtain the maximum result; we have known, however, of its being used with the coating being applied to one side only.

When this prepared paper has become thoroughly dry it is then ready for use, after having first dusted it over with a small quantity of French chalk (talc), which subdues any greasiness or adhesiveness that it may possess.

For use then, an average sheet of the printed work in course of progress is taken from the run, and laid upon the "shining-up" board. Then on top of this is laid the prepared varnished sheet, both of them being fastened down taut, and secured together to the board by means of drawing-pins placed at each corner, and an additional one or two being run through the intervening marginal spaces as an additional security.

We will now assume, for illustration's sake, that we have in hand a double crown sheet (30 by 20 inches) of coloured postcards, being printed in eight colours, and that we have only got four colours of the job done; the sheets having stretched considerably during the working of these four printings, so much so that it is now impossible to follow the original "key" sheet to which the first colour was "stuck up" to, as the dimensions of the printed colours have now become larger than the key sheet.

It becomes imperative that we must now follow the actual printed sheet itself for "shining-up" purposes, as, when each successive colour was being printed upon it, the re-applied pressure caused the sheets to "go" a little each time; so that the original "key" sheet becomes less and less valuable for the usual transferring, registration purposes under such circumstances.

Now in the technical method under consideration we employ one of the actual printed sheets of the job in progress, to serve us as the absolute, precise guide for the *true registration* of the new set of transfers of the next colour to be printed. After this is attained, we are then able to dispense with this sheet for the "running down" of them to the machine plate.

This is accomplished by "shining-up" and "sticking-up" each individual transfer upon the varnished, transparent sheet, which enables us to see quite clearly the whole of the printed work of the job, lying secured beneath it.

So that the outcome of this is, that we have now our next sheet of transfers fixed in absolute register position upon this transparent shining-up sheet; and this it is which we now use for "sticking" them up upon, and for running them down accurately to register to the machine-printing plate, instead of employing the "key" sheet.

This sheet is virtually impervious to moisture, and of an unstretchable nature, due to the duplex varnish coatings which it has received; and it does not require any further maturing in the running-down operations in transferring to cause it to adhere.

Therefore by its aid we are enabled to obtain the next "colour set" of transfers down to the plate without misfit, and in true compensation for the vagaries of the expanding sheets of the job that is being printed. No other methods we know of offer the same manifold advantages as these, which are encompassed within the range of this ingenious system, which adapts itself to every one of the peculiar and extraordinary requirements engendered by the erratic conditions of the work involved. This is our apology for having here interpenetrated a detailed reference to it; as we have found it to be so little known here in Great Britain, even amongst men who have worked in the "States," that we hasten to submit its merits for the widest participation of our confrères of the craft, as it is utilisable either for metal plate or stone.

In the "running down" it is advisable not to give a heavy pressure for the first pull through, but to gradually increase it in progression to the maximum. When the transfer is sufficiently run down to the plate, then the transfer paper and composition are washed away, and the plate fanned dry. Any "repair" or "touching up" being now done.

The plate is then gummed up; this being smoothed down to a thin, even film. The transfer is now washed out over the dry gum with the asphalt tincture, leaving but a thin layer on. The gum is next washed off with water, and the work rolled up with the black roller.

In connection with the "rolling-up" procedure, we may here appropriately refer to another "rolling-up fake" as practised by some Austrian transferrers of our acquaintance, which consists of sprinkling a few drops of the "asphaltum washing-out tincture" upon the black nap roller when "knocking it up" upon the ink slab, at, and during, the time of rolling-up the new set of transfers just run down upon the machine plate.

In some respects this practice is beneficial, but there are at the same time attendant drawbacks attached to it which are apt to nullify its other merits. These we have experienced from a careful personal testing of this method on a number of different occasions.

A passing consideration of the underlying principles of this practice will soon make clear the points at issue.

When the transferrer sprinkles upon his nap roller some of this "fluid washout," which consists principally of asphaltum powder, fats, and waxes dissolved in solvents such as turps and benzole. The precise formula for which is as follows: 10935.

Asphaltum powder	1 lb.
Beeswax	¼ lb.
Tallow	¼ lb.
Turps	5 pints
Benzole	1 pint
Oil of tar	¼ pint
Lavender oil	1 fl. oz.

This liquid solvent when sprinkled upon the black roller naturally softens and limpens the black ink with which the roller is charged. The effect of which is that this ink being then rendered temporarily flaccid and less adhesive to the leather nap of the roller, it is in this condition more readily imparted to the greasy transfer image which forms the work upon the printing plate,

when the roller is passed over it in the "rolling-up" operations, and consequently causes it to become more promptly charged with its modicum of fortifying ink than what would otherwise be the case without its aid.

But later on, after this black roller has been allowed to stand unmoved for a few minutes, then the turps and benzole constituents, being volatile bodies, quickly evaporate out, and thus leave the rehardened wax and asphaltum substances intermingled with the ink on the roller, which then in turn becomes more hard and less distributive than ever; so that when it is again brought into use it really parts with its ink so sluggishly that the transferrer experiences infinitely more trouble in the subsequent rolling-up of his work than he would have done had he omitted the use of this "washout" altogether.

This then necessitates a constant "re-scraping" of the black roller, and the "recharging" of it again with fresh ink: all of which involves extra trouble and labour upon the transferrer, and a certain amount of waste of materials.

This use then of the "asphaltum tincture" with the rolling-up ink may be permissible for emergency work only, where a mediocre job is required to be got ready with unusual expedition, and where circumstances will permit of a speedy rectifying of the roller again to its proper condition afterwards. Some transferrers use a sprinkling of turps on the slab, instead of the asphalt, as above described.

A careful reflection of these drawbacks at once reveals the superiority of the "Elbagreen" method, as described in an earlier chapter of this book.

Apropos of this we may be pardoned here mentioning that, since writing our previous reference regarding this oil, we have learned from the "Elbagreen Company" that the German lithographers have now taken it up; they first tried some small samples which proved so satisfactory that their supply houses immediately negotiated for the whole of this oil in stock, some 500 gallons, which they promptly pur-

chased outright. This amplifies the recommendation which we respectfully submitted in a preceding chapter.

But now resuming the " washing-out " procedure of the newly-formed transfer upon the printing plate and the " rolling-up " of it : there is still another alternative method of accomplishing this, which is regularly adopted by the transferrers of some few litho establishments, although we are not partial to the practice ourselves, because it is fraught with so much dirt and messy ink soil, both upon the sponge, damping cloth, and black roller.

This method consists of washing out the new transfer as before over the dried gum film ; then rolling up the whole surface of the plate solid black by means of the hand roller. This permits of a full firm layer of ink being applied to the work, because in this method there is no water present to retard or diminish the feeding of the job with greasy ink.

In attaining this, however, one has necessarily had to also ink up the dried gum layer on the plate surface as well as the ink work of the transfer interspersed amidst it. The effect of which is that a lot more ink has had to be worked upon the roller than what would have been either necessary or permissible with the other method as described earlier : as the roller in this instance carried an extra supply, so as to allow for these parts as well as the actual work of the image being fed, as one could not be rolled up mechanically without the other participating as well.

As one outcome of this, it is more difficult to afterwards dissolve off the dried gum layer from the plate, on account of this superposed layer of black ink covering it up. When, however, this is attained, that superfluous ink and gum has to go somewhere. It unfortunately distributes itself amongst the sponge and damping cloth and roller, causing delay in having to wash the former clean again, and rescrape the latter. Thus it becomes both a dirty, and a wasteful method.

True, a special roller can be kept for this purpose

alone, as can also an additional set of damping materials; but that involves an unnecessary additional outlay, over and above what is necessary with the other orthodox method, besides saddling the printer with a lot of dirty ink which he cannot safeguard himself from when pursuing this method.

CHAPTER IV.

DRY ROLLING-UP METHOD—TOUCHING-UP AND REPAIR METHODS—CLEANING-UP PROCEDURES—BEST CHEMICALS AND MATERIALS FOR USE—METHOD OF REROUGHENING SMOOTHENED PORTIONS OF ZINC PLATES —GLASS BRUSH PREPARATION.

In order to safeguard ourselves from being misunderstood, we might here concede—in relation to this "dry" rolling-up method—that there are special occasions in which it might be most advantageously employed; but these are the rare and extraordinary instances, and not the general rule.

Such for example as where the transfer had been pulled somewhat too "bare" and sparse of ink, or that the plate had been prepared with an exceptionally rough grain: or for certain grades of autographic work.

In these special circumstances this method may justify itself, on account of the advantage it affords of the building up of a substantial ink layer on the job without having to encounter the antagonistic influence of moisture during the rolling-up operation; as is the absolute condition inherent in the other, regular method.

This dry rolling-up method then is for exceptional cases, and not for regular practice, as the aim and skill of the transferrer is always directed to the procuring of a good and perfect transfer, which alone affords perfect work. No matter how many ingenious "fakes" may have been utilized to compensate for a faulty and defective beginning, the ultimate result will not vie with what would have been attained had the transfer been rendered perfect at the start.

Everything depends upon this, and this fact cannot be too strongly impressed upon the young craftsman who is transposing his energies from the "old time

s one " to that of " metalithography " for the first time. He should provide himself with a small folding pocket lens with which he should carefully examine the transfer before running it down; as, if the solids are found to be " *pin holed*," or the lines and stipple " *mottled*," then it is impossible to obtain a perfect transfer, unless those parts are " touched up " on the plate when the transfer is run down.

Hence it is that a good transfer puller is a " jewel." With " cut stone " transfers (engraved stone)—*intaglio* method, there is not the same possibility of " shaky lines " as when the transfer is taken from a *plano*—(flat surface) original.

With this latter the transfer puller is always regardful of the danger of pulling the transfer very full of ink when it has to be retransferred to stone, as with this flat, smooth surface method, the transfer spreads and becomes thickened in the re-transferring, if it is not pulled cautiously bare. It takes some little time and practice for the new beginner at plate work to recognise that the same conditions do not prevail with the metal plate, as there is a difference in the receptive capacities of the stone and the plate.

Apart from the difference prevailing in the " porosity " and " specific gravities " of the two printing mediums used, there is also the difference between that of a smooth, polished glass-like surface, as is represented by the stone, compared with that of a roughened, tooth-like surface, as is furnished, and possessed, by the zinc or aluminium plate.

The mounds of the surface granulation of the plate, even though microscopic in extent, must certainly increase the surface area of the plate, as the sides and depths of these myriads of tiny mounds have to be accounted for. This explains why a " fuller " transfer can be run down to a zinc plate without " smashing "; whereas had that same transfer been used for running down to a smooth-surfaced stone it would have spread and thickened.

We may now resume the actual transferring

procedure, so that whichever method of rolling up the washed out transfer may have been pursued, every part of the work should now appear " firm " and " solid " when the " rolling up " is finished. If such is not the case, then the defective parts should be at once made firm and perfect before the subsequent etching operation is accomplished.

If the faulty parts are free of gum, then they may be " touched up " with a sharp pointed hard lead pencil, such as a 6H, going over these defective parts with the finely tapered point once or twice, pressing moderately firm.

Or, as with the stone, the touching-up may be done with a " sable hair brush " or " litho. steel pen " and litho. " tusche."

For certain other kinds of retouching, a " Korn," " Lemercier," or " Vanhymbeck " crayon may be used.

If, however, touching-up is required to be done on any parts of the plate where gum arabic has penetrated, then in order to obtain reliable results it is necessary to remove that gum from the metal, before greasy ink will again hold there firmly. This is readily done on zinc by means of the " alum acid solution," already fully described. This solution decomposes the exposed metal, and thus presents a new virgin surface, which will take up ink as efficiently as what the new clean plate did at the start.

After the " touching-up " has been done, the plate should be " regummed," the job then " rewashed-out " with the " asphaltum " tincture, then " re-rolled " up again, and " chalked," when it is ready for the finishing operations.

Assuming however, that the transfer has rolled up all right, as it should do under normal conditions, the work is then protected for the cleaning-up and etching operations. This is done by dusting the job well over with " Colophonium " powder. This fine " resin flour " clings to the surface of the moist ink which thus becomes fully charged with a complete layer of it; then

ENLARGEMENT OF A LUMIÈRE AUTOCHROME
PLATES MADE BY

a final dusting over with "French chalk" (talc) follows. This latter frees the plain parts of the plate from any particles of Colophonium powder that may be adhering there, and at the same time, its finer particles fill in any possible cavity of the work that may have been missed by the Colophonium powder.

Both of these powder substances being absolutely insoluble in the etching fluid they thus form with the ink of the job a perfect resist and preservative of the ink image during the etching operation.

"Colophonium" powder forms with the ink image a most powerful resist, and may be recommended for all transfers, where no "scum" is present.

But in the case of "copperplate transfers," where a slight scum is always present, no matter how carefully they may have been finished off in the inking manipulations, here, for this class of transfer, it will be found that fine "asphaltum powder" forms the best etching resist, as it is not so adhesive to the thin ink veil which comprises this scum, as what the more "sticky" (adhesive) Colophonium powder is.

Where, however, there is the firm and full deposit of ink, such for instance as that which belongs to the work of the transfer proper, as the lines and dots, which form the image of the work on the plate, there the Asphaltum powder will firmly adhere, and securely protect the work from injury by the etching fluid. But on the contrary, where the scum only carries just sufficient ink to make its presence recognisable, but not enough to satisfy the anchorage requirements of the dry asphalt powder, this scum receives no protection against the action of the acid etcher, and consequently becomes undermined, and cleared away, which is the precise condition which is required of it.

But if, instead of this Asphaltum powder, we had used the Colophonium powder, we should have experienced the greatest difficulty in undermining this scum, as this latter possesses such clinging, adhesive powers, that we would necessarily have weakened the surrounding work, while trying to remove the extraneous scum

matter from the plate. In "cut stonework" there is not the same liability to this scum as in the copper-plate method in vogue in Great Britain.

If the young transferrer will remember these relative viscous properties of these two etching resist powders, he will then always have at his command the means whereby he may apply to best advantage the right one for the right condition, and thus obtain a great advantage and help in his work therefrom.

Whichever of these two powders should be used, the final dusting over with French chalk is always resorted to.

It may be here mentioned that there are a number of transferrers who are so delicate in their touch that they can carry out the etching operations when only French chalk alone is used for "dusting in" the work. But we do not recommend this, as there is invariably an occasion where some part of the work suffers from this "over-confidence" method.

Now we come to the "cleaning-up" of the plate as the next consecutive operation, and here again we find

Fig. 11.—Glass Etching Brushes.

a variety of methods of procedure, all of which we shall refer to and emphasise that which we consider the best, and the reasons therefor. The superfluous ink, or dirt portions, may be removed by the aid of abrasive implements, such as "fine glass brushes" (Fig. 11), consisting of a tightly bound rope of glass threads; or a "pencil point of hard wood"; or a "stem of pipe clay"; or an "Indiarubber pencil"; or a piece of tapered charcoal"; a "sharpened goosequill" is also

used by some; a polishing "pencil of snakestone," just as is employed on stone, may also be used for certain corrections; while marginal dirt may be removed by means of a piece of "felting," or closely "woven flannel."

Even a "steel scraper" may be used for sharpening up a line, if a good and efficient etcher is employed for the final etch.

Now, since it is necessary to have a grained surface on the plate in order to secure proper moistening, or damping conditions, it follows that when we polish or abrade a portion of that surface in the cleaning-up operations, that we make those parts smooth and flat, and thus incapable of retaining the same storage of moisture, as the remaining roughened surface of the plate possesses. Therefore, any method that will either minimise, or obviate that drawback, renders a service to the lithographer.

If the wood stump should be used in cleaning dirt away, then the point of it should first be dipped in the "etcher," and then in some "medium pumice powder," and then used on the parts of the plate requiring erasure in a circular manner, so as to preserve the grain of the plate. If a rubber strip is employed, this is then almost impossible to be carried out, as is also the case when a piece of snakestone slip is used.

In these cases the plate should be finally bathed in the alum acid bath (affinitiser) for about three minutes, when the acid again produces a matt roughening on those smoothed places, with this comparative difference —that the grain is very much finer than that which is produced with the graining machines. If there should have been only a few parts polished smooth in the cleaning-up operations, then, instead of bathing the whole plate by immersion, those parts may be treated locally with the alum acid solution by means of a camel hair brush; the spent acid being removed with a sponge, and fresh applied for about two minutes, as in the bathing procedure.

Instead of the above methods, if one should be

employed which dispenses with the smoothening effects on the plate there is then no need for the alum acid bath in connection therewith.

Such a one is obtained when the cleaning up is done by means of a " stump glass brush " and " caustic soda solution." In using this method the cleaning up should preferably be done on a dry plate, otherwise there is the risk of the erasive soda encroaching upon the good work of the transfer, and damaging it. But if the plate is fanned dry before proceeding to clean it up, and the caustic soda solution is coloured with a small quantity of rouge powder, then every erasure by it, and application of it will be clearly shown; this residue of it is then removed by a piece of blotting-paper, which prevents subsequent injury to the surrounding work of the plate. A final dab with sponge and clean water removes any remaining caustic film.

One end of these glass brushes requires to be brought to a point, for the purpose of getting in between close spaces, where there is only room for a small cleaning-up tool of this character to enter.

To obtain this condition, one end of the brush is dipped into a strong solution of gum arabic, so that it penetrates well in between the innumerable glass fibres; then this gum is dried on the brush, so that all the fibres are well knit together and held firm. It is then taken to a grindstone or carborundum wheel, and the outer parts of the brush ground away in a tapered direction, so that the point of it is brought to a pencil-like end. It will be necessary to redip the brush end a second time, if it should be a very thick one, or if the gum solution has not fully and efficiently penetrated the inner fibres of brush. Finally, the remaining gum is dissolved off.

By utilising this method then, the grain of the plate may be preserved in those parts, when dirt and superfluous ink have to be removed; and thus the whole plate surface may be kept in a uniform, roughened character, dispensing entirely with the necessity of the acid bath treatment again, after the cleaning up.

This is by far the better method, although we have to recognise that it cannot be used for every job and that it is not used nearly as much as the other methods; at least so far as the craft in Europe is concerned.

Of course, the preceding method can be closely imitated if the brush and a mixture of corrosive acid solution were used (nitric, hydrochloric, etc.), but this is far more dangerous and destructive to adjacent work, unless the greatest care is exercised in its use. Necessarily, the object in any method should be, that it is easy to work, with a minimum of risk.

Even when cleaning up is done by the rubber, or wood pencil method, and the phosphoric etcher used in conjunction, it is advisable to colour the solution, so that every erasure is visible on the plate, and thus afford the transferrer the assurance that he is not inadvertently encroaching upon the good work of the transfer.

The use of a rubber strip with a solution of red American potash is favoured by some transferrers for "cleaning up" with.

CHAPTER V.

ZINC ETCHERS OF PARTIAL CORRODENT COMPOSITION—BEST FORMULAS AND RECIPES, ENGLISH AND FOREIGN—SENEFELDER'S ORIGINAL METAL PLATE ETCHER.

If the "steel scraper" or "erasing knife" should be used in any part of the transferred image, care must be taken that no very deep "digs," or "channels," are cut out with it, it being only necessary to remove but the very barest superficial part from the plate, as the work is not so deeply penetrated as on the stone. It follows that these parts so treated will present a *smoothened* surface there afterwards, in which condition they would be incapable of retaining the requisite supply of dampening moisture during prolonged running of the press, so that it becomes imperative that those portions shall be "*roughened*" again by treatment with the acid bath solution there, to give them at least a chemical grain, in lieu of the mechanical one which had been destroyed by the steel scraper.

When all the cleaning up is finished, the plate is then gummed up, and again rolled up with the nap roller and good black ink, in order to make sure that no part of the image has been injured by undue rubbing, during the foregoing operations of cleaning up.

It is next dusted over with French chalk, and is then quite ready for the ETCHING operation.

This operation is of the utmost importance, as on the success of it depends the unbroken running of the printing machine. Here comes in the question of the perfect, or the faulty etcher. There are "formulas" and "recipes" galore. Some printers are satisfied with one, which other printers taboo. It is well to here note that the vast majority of them still contain in their composition the same old erosive acid which the

'old master," Senefelder himself, introduced in 1817, namely, "Phosphoric acid."

There is a proprietary etcher of an entirely new constitution to any hitherto used, and which is unquestionably the best that has ever been discovered for metalithography; but as this is protected by patent laws, in both Europe and America, the formula of it could not be used unrestrictedly without violating the proprietary rights. It consists chiefly of ammonium compounds and the salts of Arabic acid. We shall return to this fully in a subsequent chapter.

We shall therefore first confine ourselves to a good, non-proprietary formula, which is being used with success in a few good English firms for zinc plate work; it is as follows:

ZINC ETCHER.

Phosphoric acid	3 fluid ozs.
Tannic acid, dissolved in hot water	2 ozs. 1 oz. by weight
Water	15 ozs.
Chromic acid	2 ozs.
Gum solution	10 fluid ozs.

Another one, time honoured in age, yet which still finds quite a number of users, despite the simple and unpretentious nature of its composition, is made up as follows:

ANOTHER ZINC ETCHER.

Decoction of Nut Galls	1 pint equals (20 fl. ozs)
Weak watery solution of Gum Arabic	½ pint equals (10 fl. ozs.)
Phosphoric acid	4 drachms by weight

To prepare the above, 9 ozs. of best Aleppo Nut Galls are steeped in six quarts of water for twenty-four hours. They are then boiled and "crushed up" during the boiling, as well as being well broken up before steeping. Finally straining and bottling up ready for

use, labelling them "*Stock* decoction of Nut Galls." (Note, they should boil for ten minutes longer after CRUSHING.)

This etching solution desensitises the plain parts of the zinc plate, and enables them to resist the encroachment of the greasy litho inks.

The following is one imported from the Continent and virtually similar in character to the above, except the quantities, and the powdered gallic acid, instead of the decoction of the same chemical principle.

It consists of—

Gum Arabic solution	8 parts
Phosphoric acid	1 part
Gallic acid	2 parts
Water	14 parts

In Scotland we found a few firms where the following rather vigorous formula was in vogue:

Gum Arabic solution	40 ozs.
Hydrochloric acid	1 oz.
Phosphoric acid	1 oz.
Citric acid	1 oz.
Common salt	1 oz.

The whole diluted for use with about equal quantity of very thin gum water.

In Ireland, on the contrary, the constituents of the zinc etcher was reduced to a minimum. Simply

9 parts of gum solution.
1 part of phosphoric acid.
Water as required.

This was the typical etcher for zinc plates where the workmen prepared their own etching solutions.

It may be here mentioned that probably one-third of the lithographic firms using zinc plates purchase their etching solutions from the supply houses; this rule applies to virtually the whole of the United Kingdom. It is the ruling custom that each large supply firm of metal plates for lithography also put up their own

etching solution for their manufacture of plates, and make a strong point of urging purchasers to use their etcher solely, with their particular brand of zinc plates. Such is the case with firms like Penrose's, (Horsells) Parker's, and Algraphy Ltd.

It does not follow that this practice is now followed altogether loyally, as we have frequently discovered different makers' proprietary etching solutions being used with other makers' plates, and generally with as satisfactory success.

Again we may remark that we have found zinc etchers in successful use in which precisely the same kind of ingredients have been employed, but in many different quantities and proportions of these various ingredients.

Below is another instance of this, in which the following proportions were used with satisfactory results:

Gallic acid	10 parts
Phosphoric acid	2 parts
Gum solution	10 parts
Water	30 parts

In another instance the following formula was giving good results:

Phosphoric acid	2 ozs.
Chromic acid	2 ozs.
Gum solution	12 ozs.

Yet quite different proportions of these self-same materials were giving also satisfactory results, as is depicted in one of the preceding formulas where an analysis comparison can be made of this marked variation, or change of proportionate quantities in the etching solutions.

Turning now to the method of zinc etching, as is employed by French lithographic printers, we shall note that even there the fundamental constituents of the etcher is akin to that in vogue in the British Isles and other parts of the Continent.

The following is the composition of an etcher for litho zinc plates, with which they obtain good results:

French Etcher.

500 grammes brown gall nuts, well powdered up,
1 litre of water.
20 centilitres of Sulphuric Acid (H2 SO4).
10 centilitres of Nitric Acid (HNO3).
400 grammes of Gum Arabic solution.

The nut galls, after being reduced to as fine a state of powder as possible, so as to facilitate their dissolution, are then boiled in a litre of water (rain-water by preference) by means of a water bath (*bain marie*), *i.e.*, an earthen vessel placed in a saucepan with water. These should be put to simmer on a slow fire for three or four hours, then left to cool, then the liquor added to the other ingredients, the whole being well stirred together, strained, and bottled for use. If necessary for any special fine work, it may be further reduced in strength by adding rain or distilled water to it accordingly. Hard or limy water tends to neutralise the acid properties.

A customary French method of applying this to the plate is to use a broad camel hair brush and spread the etcher with it over the zinc plate, just as is done in etching a grained stone for chalk work, instead of using a sponge where the liability of unequal and irregular etching may ensue.

The length of time this etcher is allowed to remain on the plate is usually one and a half minutes. After which the plate is carefully washed with clean water and gummed up with pure gum arabic without any additions, such as tannic acid or bichromate salt.

Now, if we may be pardoned looking backwards for about a century, we shall find how little—not how much—variation has been introduced into these essential etchers for lithography, for the immortal master of lithography (Senefelder), when writing his memoirs of

the craft in 1817, actually describes the composition and use of the following etching preparation which he used : "*An infusion of nut galls and gum water with phosphoric acid.*" This will be found in both the original German memoir, as well as the English translation published in 1819.

CHAPTER VI.

PROPRIETARY NON-CORROSIVE ETCHER (OR, STRECKER METHOD)—A LANCASHIRE COMBINATION ETCHER OF CORROSIVE AND NON-CORROSIVE COMPOSITION—THE CHEMICAL AND PHYSICAL ACTION OF "GUM" UPON ZINC PLATES—GUM SUBSTITUTES AND TANNICISED GUM.

In "Spon's Encyclopædia of the Industrial Arts," published in 1882, over a quarter of a century ago, is the following recipe for zinc plates: Gallic acid, 25 grains; phosphoric acid, 8 grains; gum arabic, 130 grains; water, 837 grains.

Here, then, is virtually the same etcher introduced and used throughout a whole century, and yet which is practically the essence of the free corrosive etchers still in use in all parts of the world to-day, so far as lithographic metal plates are concerned, with the solitary exception of a recent patent proprietary etcher, as referred to in a previous allusion—which is a non-corrosive one—the composition of which is as follows:

Nitrate of ammonium	21 parts
Biphosphate of ammonium	20 parts
Gum arabic	200 parts
Water	750 parts

This etcher requires a three-minutes' action upon the plate to effect the desensitised coating.

The hygroscopic coating which this produces upon the zinc plate is accomplished in accordance with the following equation:

$$3Zn+2\ NH4\ H2\ PO4+3NH4\ NO3+C12H20O11=Zn3P2O8+3NH4\ NO2+C12\ H20\ O11\ (NH4)\ 2+3\ H2O.$$

This is the basis of the non-corrosive etcher which

positively gives the best results on zinc, and attains to the very highest state of perfection yet acquired in lithographic metal plate etching.

In this connection we came across a large Lancashire lithographic printery that compounded an etcher, which comprised both the " non-corrosive " etching constituents, to which they added also a strongly " corrosive " one. The composition of which is as follows :

Potassium Phosphate	2 ozs.
Potassium Nitrate	2 ozs.
Sodium Phosphate	1 oz.
Sodium Nitrate	1 oz.
Sulphuric Acid	50 minims
Water	80 ozs.

It is both interesting and remarkable to relate that this mixed etcher gave satisfactory results on both flat-beds, rotaries, and two-colour offset rotaries.

Senefelder found that all metals had an affinity for fats more or less, and singled out " zinc " and " iron " as being the two most valuable metals of those days for use in the lithographic process. He further stated that " lime and gum, as also potash with salt and gum, form a good means of preparation for all metals " used in lithography.

Now, whichever etching solution is employed for either zinc or aluminium plates, the object to be attained in its use is the production of an insoluble coating upon the plain, blank, uninked portions of the plates, such coating being of a hygroscopic or water-bearing and water-retaining nature, and consequently of grease-resisting capacity. In other words, " desensitising the plate to the action of greasy ink wherever this etched coating, or layer, has been formed."

The more stable and constant that this new hygroscopic layer can be procured, the more perfect the printing results will be. The main trouble hitherto encountered on zinc and aluminium plates has been the imperfect treatment, and inefficient etching operations available for these plain, blank parts—the etched

coating that has been formed there being partially soluble, or decidedly so. Then when the results of the etching were so easily removed, the trouble of "scumming," "tinting," and "degradation of the work" ensued.

So that the troubles of metal plate printing really resolved themselves into this: that it was quite easy to maintain the "ink-bearing parts" of the printing plate; but the "blanks" or "lights," or "inkless parts," as they are variously termed, were the real sole trouble, and which the machine-man had to grapple with, and which always baffled him the most. Invariably the outcome of this necessitated him in "doctoring" his ink, or "doctoring" his damping water, or as frequently doing both at the same time.

Now, then, having accomplished the etching proper, if the "rarefied corrosive" one has been employed, it is then necessary to carefully wash off the superfluous solution, and finally to gum up the plate and fan dry.

Here again this operation may be either simple and plain, or done in a more complex manner.

If plain, then a thin coating of "gum arabic solution" is applied, and finally spread evenly and sparsely all over the plate surface by means of a clean, spongy gum cloth, kept exclusively for this purpose; care being taken that only an absolutely thin film of gum is produced, otherwise great difficulty will be experienced in the subsequent "washing-out" of the design when commencing printing at the power press.

Moreover, there is the liability of the gum to peel off in thick scales if left too thickly on the plate. Again the thin layer expedites matters, as it can be readily fanned dry; whereas the thicker layers resist this, and delay progress in the work.

Now, with the "complex," or compound manner, an additional salt, or, in other cases, acid body is mixed with the gum.

One method is to mix up a small quantity of tannic acid with this gum solution, and gum up with this addition to the gum.

The other method is to mix a small quantity of a saturated solution of "bichromate of potassium" and pour a little of it on top of the wet gum layer, then well sponge into it, this dissolved salt, spreading on a thin layer and exposing same to light for a few minutes, taking care not to allow it to become indissolubly hardened by light action, or a hard, horny, insoluble layer will be produced, which will necessitate such stringent measures to remove it that the subjoined work of the transfer will also be affected and impaired. Hence, more harm than good would accrue from its use under such circumstances.

Otherwise used with due restraint, some appreciable benefit may be found from its use.

Of the two methods, however, we prefer the gallic acid one, as there is no such restrictions attending its use as in the bichromate one just under review.

The "tannicised" gum may be made at the time of gumming, or prepared beforehand. Some transferrers add a pinch of tannic acid to the gum at the time of gumming in.

A few simple, plain remarks upon the "chemical basis" and "underlying principles" will help in the mastery of zinc plate printing. It is well to bear in mind that gum has a "chemical action" upon the plate, not a mere "mechanical" one, and that true and full chemical action does not ensue until this gum has been dried upon the plate; that is, the action is only completed by the gum absorbing free oxygen from the atmosphere, and also being freed from its excess moisture of solubility. As with other organic substances, the reactions are "shrouded in complexity," but a similar combination takes place with the metal as is the case with the stone, only that a "metagummate of zinc" is formed instead of a "gummate of lime." The chief constituents of the gum being the "potassium" and "calcium salts" of "arabic acid." Therefore, if the printer should have occasion to re-etch his plate, or any part of it, he will not attain to the full value of the gumming-up operation

if he merely "gums up" and then immediately afterwards washes the gum off again before drying it firmly on the plate. The plate will not be rendered as immune to grease as it otherwise would be if he had taken more time to perfectly complete the drying operation.

When the vegetable astringents "tannic" or "gallic acid" is used in conjunction with the gum, the same feature there applies, as both of these acid substances are alike in their nature, and are derived from the same source—the "gall nuts" and "barks"; also being, like the gum itself, organic vegetable products.

Substitutes for the pure gum arabic should not be used, or attempted for use, on either zinc or aluminium plates, as even mixtures of "Dextrine" (British gum), or "Gum Senegal," retard the formation of the stable compound that should be produced by the pure gum on the plate. The "best is none too good" for plates.

It should ever be remembered that the main element, zinc, cannot in itself alone imbibe and retain sufficient moisture to enable it to reject greasy ink; that condition alone is imparted to it when some chemical substance is applied to it which enters into chemical union with it, producing a new chemical compound, which is of an entirely different nature, to that, of what the plain elemental zinc was comprised before receiving this new alliance.

That is precisely what the "etching," and "gumming" operations are intended to accomplish.

When these operations are carried out efficiently, then the nature of the zinc is so completely changed that you might roll up a plate solid black, and then, on the application of moisture, the ink would all come away again wherever the etching and gumming had been carried out; but on the remaining portions of the plate those that represented the *ink lines* of the *design*, and which had been insulated by French chalk and resin, from the action of the etcher and gum; these would still retain the ink, and reject the moisture. Thus the whole matter resolves itself broadly into this: that the zinc plate is capable of having formed upon it

two entirely and *distinctly different compounds*, one a *greasy* or *fatty compound*, the other a *gummy* or *anti-grease compound*.

With the former, we have nothing like the difficulties to contend with which we have with the latter; therefore, we have to aim at directing our progress along the lines of the latter difficult phase of the work. It is here that the worry and trouble assails the printer; he may have "scumming," "tinting," or "spreading" of lines, etc., on this side of his work; and may also have to work such a large quantity of water, to safeguard against encroachments on these blank portions of his plate, as to even weaken the vigour of his print, and to debase the tinctorial power of his ink.

Again, the natural attrition of the plate during prolonged printing operations always tends to wear its surface smooth, *i.e.*, destroy its granularity. When that stage is arrived at, then another additional grievance is showered upon the printer and pressmen, in taxing their resources and energies, to cope with, and compensate for this inherent trouble, which imperatively demands attention and redress.

These are the chief problems that the metalithographic printer has to face, and which he is now so successfully doing in many parts of the world, as the really beautiful lithographic productions now being done from metal plates clearly testify and prove.

CHAPTER VII.

ARTIST'S WORK — AEROGRAPH-SHADING MEDIUMS — GUMMING-OUT—CORRECTIONS AND ALTERATIONS—ERASURES AND ADDITIONS—COMMERCIAL WORK FOR OFFSET, ETC.

ORIGINAL drawings are produced upon zinc or aluminium plates in precisely the same manner, and with the same lithographic materials, as is employed for stone work.

The lithographic chromo artist, or commercial artist and draughtsman, can employ either sable hair brush, litho. pen, litho. crayon, rubbed tint by wash leather, the aerograph, shading mediums, or splash methods, according to the technical requirements and character of the work. He can work upon the plates more conveniently than upon stone.

For "offset" work, the drawing is done *right way to view* upon the plates, which makes it much easier for the lettering hand when he is doing Old English, Roman, and Script forms, as in Fig. 12.

Metalithography *Metalithography*

FIG. 12.

There are one or two restrictions, however, in connection with drawing upon metal plates, to which the young metalithographic artist must be apprised. First he must learn to refrain from making rough sketches upon the plates with a hard lead pencil, such as a 6H, as each heavy stroke of this graphite point will take up printing ink, and thus produce blurred outline.

Again, he must remember that the metal plate is

somewhat more susceptible to greasy fingers than what the stone is, therefore he should always protect his work with a sheet of clean paper, and work upon a gently sloping bench, employing a bevelled portable flat hand rest, as in Fig. 13.

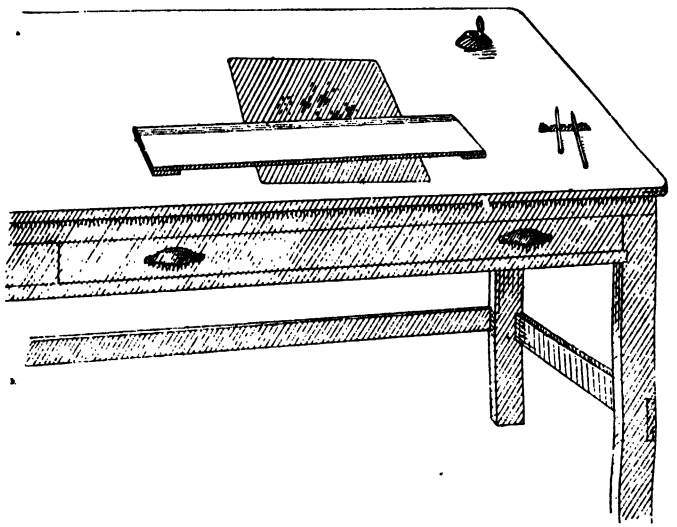


Fig. 13.

A clean "hare's foot" may be used for lightly dusting over the plate in removing grit or fluff.

"*Chalk*" *Work.*—In executing "crayon" work upon a grained plate, Korn's Litho. Pencil Crayons are a very convenient form of crayon for clean and expeditious work, as the paper covering which forms the holder of this crayon can be speedily removed, and the point "fined-up" on a piece of fine "cabinet" paper, and smooth finished upon a piece of "matted glass," or brown paper, which gives a nice working point. Or, if preferred, "fine pointing" may be done with a sharp penknife operated inwards towards the artist. Messrs. Gilby & Hermann, of Plumtree Court, London, are the sole agents of these pencil crayons (Fig. 14) for Great Britain.

The ordinary form of crayon (round or square) may, of course, also be used with the Porte crayon.

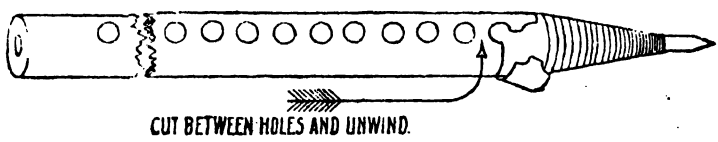


FIG. 14.

"*Tracings*" are best made by the artist upon the metal plate in the following manner: "Lay" on, or "pin" down, a piece of tracing paper over the original copy, and trace the outline upon it with a Conté crayon. This tracing is then laid face down upon the plate, and a "feint" of it rubbed on to the plate with the thumb nail, a wood or bone presser, or a paper stump. This gives a clear outline, without in any way injuring the grain, or choking up the surface of the metal. (Tracings may also be done with the usual red chalk paper, etc.)

"*Gumming-out*" is done upon the plates in the same manner as upon stone, the gum being slightly coloured with a touch of vermilion, taking care that the plate is free of moisture before starting. It may be slightly "warmed," or "fanned dry," to ensure it being in condition, as a damp plate causes the ink to run.

When the "gumming-up" is completed, it should be dried quickly by "fanning," to prevent "spreading" or "oxidation" troubles. Special precaution must always be taken not to use "sour" gum.

"*Aerograph.*"—This apparatus is a most useful adjunct to the metalithographic artist department; as, by its aid, he can expeditiously produce every depth of "shading" texture, from the *heaviest shadow* to the most *delicate lights*, encompassing all the intermediate tones, in a reliably uniform and economic manner.

This spray process is utilised for reproductive pur-

poses in a wide range of lithographic work, reaching from "picture postcards," "children's picture books," away on through "show cards" to mammoth "posters."

For a full compass of "graduated background work," this aerographic method enables perfect results to be obtainable in one printing alone, and which would not be surpassed or equalled for softness and range of delineation even by the finest "stipple," though done in three workings of light tint, mid tint, and dark. (See specimen illustration of aerograph work herewith done from an aluminium plate and the rubber offset machine.)

The sole makers of this apparatus are the Aerograph Co. Ltd., 13, Holborn Viaduct, London, E.C.

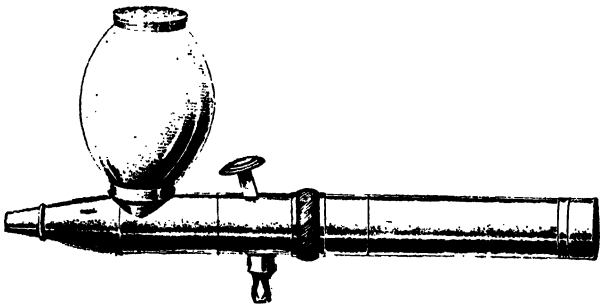


Fig. 15.—The "Aerograph" Air Brush.

"*Shading Mediums.*"—These mechanical shading films, which can be had in 85 different varieties of texture, such as "mechanical stipple," "straight and wavy line," "canvas texture," "hand stipple," "grained and graduated patterns," etc., can all profitably be used upon zinc and aluminium plates. Small portions are rubbed in by means of a stylus, a small hard paper cone, an agate burnisher, a small rubber roller, or by the thumb nail.

Ordinary lithographic transfer ink thinned down with some "lavender oil" is very satisfactory for inking the films up with, using a felt and strawboard

pad for supporting the films upon during the inking-up procedure with the composition roller.

Artists' Corrections, Erasures, and Additions.—The artist may himself remove a faulty portion from a *zinc plate*, by first removing the ink with some benzole; then destroying the greasy image with some strong caustic potash solution applied with a "quill point," or a "glass brush," or a "rubber strip." This must be then carefully blotted off, and may be repeated for safety; then the corrected portion should be gone over for a couple of minutes with a small quantity of the "affinitising" solution; finally sponge the parts with clean water, and then fan-dry quickly, when any addition may be put in as desired.

For aluminium plates the caustic is also used; or hydrochloric acid may be employed. The *resensitising* of the part is here done with a 4 per cent. solution of oxalic acid, then blotted, and finally well washed with clean water and dried. It is then ready for the artist.

Messrs. Pemsel & Lembke, of Turnmill Street, London, have recently brought out a new single solution which is capable of resensitising both zinc and aluminium plates as well as stone.

The original drawings or engravings when finished are taken over by the transfer department, and treated as described in "Proving" chapter.

CHAPTER VIII.

ENGRAVING ON METAL PLATES—HAND ENGRAVING METHODS AND TOOLS—MACHINOGRAPHIC ENGRAVING—ENGRAVING BY THE ETCHING METHOD—FORMULAS AND RECIPES—PROVING—COLOUR HAND ROLLERS.

It is an all-important and remarkable fact, that, although lithography is a "flat-surface" printing process (planographic), yet it can also be practically applied as an "intaglio" one as well, and worked upon the metalithographic principle.

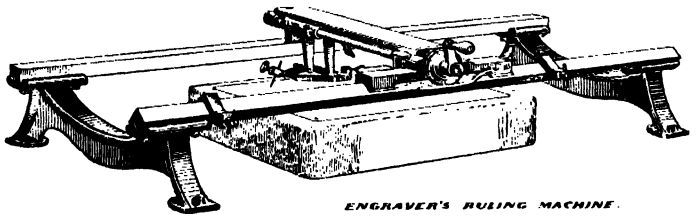


FIG. 16.

The same scientific and manipulative working principles are involved, and maintained, during the actual printing operations in the one method as in the other.

Either hand or machinographic engraved original work may be done upon these zinc or aluminium plates, although zinc is the most universally adopted metal used for this purpose. Hand engraving is resorted to where individuality line and expression are required, but for geometrical and mechanical work an engraver's ruling machine is employed, similarly as for "cut stone" work. For a large portion of this machine-engraved work the Parker wafer plate is much used and esteemed. (Fig. 16.)

The chief and salient difference in the "plano" and "intaglio" methods lie in the preparatory stages

of the work. It is in the mechanical preparation of the "cut-in" design that the first variation exists—*i.e.*, where this intaglio lithographic image differs in character from the transferred or drawn one. After this, however, it loses comparison, as the principles of printing are "on all fours" with each other.

The greasy lithographic ink fills in the "intaglio image" and repels the damping water which is indispensably essential to keep the plain parts free of ink, just as is the case in the ordinary planographic procedure. The inking rollers feed up the "intaglio" image just as they do the flat surface one. The automatic damping operation is precisely the same, as is also the impression of the ink image to the paper.

But there are inherent advantages in this metallic engraving method of lithography which prompt us to give the uninitiated every facility for learning the respective details, formulas, and secrets of the process as applied to metalithography. Instead of the engraving being done upon lithographic stone, and then transferred to metal plates, the engraving is best identified with the plates right through without recourse to the stone at any stage of the operations. Printing can thus either be done direct from the original plate, or the plate may be reserved as an original for the purpose of pulling transfers from for retransferring.

The novelty of the first method which we here refer to and describe lies in the *preliminary etching operation*, inasmuch as a non-soluble etch formation is secured upon zinc for this purpose. So far as actual engraving upon zinc is concerned, there is no novelty in that, as it has been practised over the best part of Europe, but the precise method of doing it as here described is a novelty.

The various operations are carried through as follows: A perfectly cleaned, and grained old metal plate, possessing an even grain free from coarseness, is cut to a suitable size. For example, we should take a 22 B. W. G. plate and thoroughly affinitise it in the alum-acid bath for about five minutes, then wash it well with

clean water, taking care that no scum is left upon its surface. Or a medium fine grain Parker plate, or Algraphy plate, fresh from stock, would suffice equally well.

The next operation is a most important one, and must be thoroughly well done, as much of the success of the process depends upon it. It consists in *etching* the surface of the plate so as to desensitise it to grease, and to form an insoluble hygroscopic metallic compound. This is done by immersing the plate for about four minutes in the No. 1 Strecker etching solution as described in a previous chapter when treating of zinc etching with these ammonium compounds, or any other good reliable zinc etcher. The plate surface is next gummed-up and fanned perfectly dry. The gum is then washed off, so that only that which has combined chemically with the plate remains left attached to it. The plate is again dried thoroughly.

We should now have obtained a superficial surface upon the plate which is definitely hygroscopic, and impenetrable to greasy bodies. Our lithographic image has subsequently to be formed below this hygroscopic surface, at a lower depth in the metal than where this anti-greasy compound has been formed.

The plate surface now receives a thin coating of the following acid resist ground :

Asphaltum (Syrian)	9 ozs.
Unbleached Beeswax	2 ozs.

After these are thoroughly melted together and well mixed, it is allowed to cool down.

In order to render it sufficiently fluid to enable it to be spread over the plate with a broad camel-hair brush, some Benzole or Spirits of Turps is added to it. As this substance is considerably tacky in the moist state, it is necessary that the coating should be done in a room as free from fluff and dust as possible ; otherwise, when the coated plate is left to dry, it will become covered with this foreign matter, to the detriment of the subsequent operations.

The coating does not take long to dry, as the liquefying solution is of a very volatile nature, and this is apt to cause a detachment of any loosely fixed hairs in the brush, if the operation of coating the plate is unduly prolonged. Any such adhering hairs from the brush must be removed from the plate.

It is now important that the coating shall be given a dark colour. To effect this the plate is gently and evenly warmed, and then held over the flame of a "candle," or of a "tuft of smoking tarry rag," so that the smoke will mix with the asphaltum film which has been rendered pregnable through the heat. A uniform black appearance should result, which will enable the draughtsman engraver to discern his work more clearly as he proceeds.

A *tracing* of the work that has to be engraved is now made upon this blackened surface with either a "red" or a "yellow set-off" paper. The engraving is now done either by hand or machine methods, or by a combination of both. For plain work, the engraving may be done with graver or needles of different degrees of fineness. For very fine and delicate designs the work is best done with "diamond" or "sapphire" points.

In this present method it is not necessary to cut deep into the metal; it is only necessary to cut through the protective coating, or faintly scratch the surface of the plate, so as to ensure that none of the asphaltum coating remains uncut where the tools have been used upon it in the making of the engraving, as otherwise the subsequent etching procedure would be faulty.

As soon as the whole design is completed, any errors should be touched out with the asphaltum mixture applied with a small brush.

The plate is now ready for the etching or incising operation. To accomplish this the following bath is prepared:

Water	14 parts
Nitric Acid	1 part
Hydrochloric Acid	1 part

One etching of about six minutes' duration should suffice, provided the proper thicknesses and degrees of the lines have been made in the drawing. Each job, however, may vary in the matter of time occupied, as half that period would suffice for some jobs.

The plate is next well washed in clean water and fanned dry.

The lines of the engraving are now filled in with litho. ink (tusche) which has been dissolved in turpentine. When this has dried the acid resist coating is removed with turps and a clean rag.

The plate is then inked-up, cleaned up, etched and gummed, when it is ready for use.

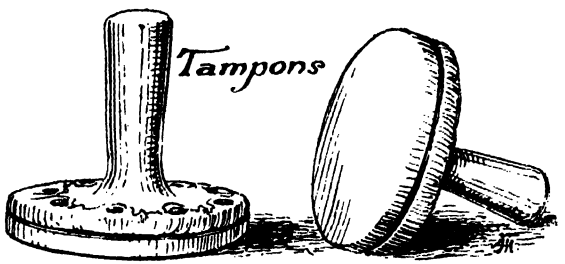


Fig. 17.

The inking-in of the engraving for pulling impressions or for transfer pulling purposes, is best done by means of "tampons" (Fig. 17), in the same way as with stone engravings. The nap roller may also be used.

The subsequent operations in the pulling of the transfers are purely everyday items of metalithography as have been carefully referred to in previous chapters of this series.

Proofs are best pulled on an India, or plate paper, using a soft backing such as blotting-paper or flannel, or sheet of thin rubber. These prints may be made and mounted at the same time if the back of the India paper is sparsely pasted and laid in position on the plate; then the plate paper mount laid on to this direct;

and finally the backing sheets before the impression is made.

There are, however, other methods of doing this *metalithographic engraving direct* without the intervention of the additional etching-out of the intaglio design. In other words, of accomplishing the engraving solely by the aid of the engraving tools and implements alone, just as is done with the litho stone; this latter method is much resorted to in many important lithographic districts, and is simpler than the preceding method, although perhaps not as capable of rendering individual mannerisms of skill as the other, which enables stopping-out of tones, and repeated etchings of others to effect contrast.

This cut metal ruling is also employed on machine plates, it being the practice in some countries to first transfer a sheet of invoice headings, etc., on to a zinc plate, and then afterwards to engrave the "money," "date," and "quantity" columns, both the down and right angle lines, in their proper position—under the headings—upon the plates.

This gives the sharpest *printing line* it is possible to attain, and one that will not wear away.

These "intaglio" processes of lithography are now being employed at many process and litho. houses for producing *fine half-tone lithography* by both high-light and orthodox photo-process methods.

"*Proving.*"—It is the task of the lithographic "prover" to receive the plates from the litho. artists as soon as completed by them, and then to first prepare them ready for printing purposes. Afterwards to "prove" them in the respective colours in due progression if it should be a "multi-colour" job; and if a "monochrome" one, then in the particular colour agreed to by the customer.

On receiving a finished original plate from the artist, the prover first "French chalks" the work, for the purpose of preventing any smearing, or dissolving of the ink. He then gums up the plate with an even coating of Gum Arabic solution of the consistency of

cream. This he smooths down thinly with a "gum cloth"—specially kept for this purpose—and then thoroughly dries this coating.

The work is then washed out over the *dried gum* with the "asphaltum" solution, after which the gum is washed off, and the work carefully and crisply rolled-up.

When all is firm and sharp, it is protected by dusting over first with "Colophonium" powder (resin flour), finishing with French chalk; any necessary "cleaning-up" is now done, and the plate etched, and finally "gummed-up" and "fanned dry," when it is ready for proving.

Some provers practise a variation of this method, by making the special precaution of "washing out" a second time after the "etching" and gumming, and re-roll up to ascertain if all is "O. K.," then French chalk, gum-up, and fan dry.

Others again prefer to gum-up after the "cleaning-up," and then re-roll up, and "French chalk" again, then "etch," "gum," and "fan dry."

In "proving" a "chromo job," the first colour—usually a yellow—for this the sheet of printing paper is laid in position upon the plate to "corner register marks" made with silver wire, or they may be "scratched-in" lightly upon the plate.

Then the remaining colours are "needled" from the *centre point of the cross line register marks*, which ensures the keenest and most reliable superposed register of a colour job.

Some provers do the registering by "lay marks" all through, but the needle method is the best, both for adjusting "stretch" or "shrinkage."

The prover should keep "progressive" proofs of each stage of the job, as well as single colour impressions of each plate, in addition to the finished proofs. He should also keep one set of proofs with a record of the colours used, both for "tints" and "body colours." This can then be consulted by the printer subsequently, if he has any difficulty when mixing the

colour for the machine. A touch of "sperm oil" in the colours helps them to print flat, and sink in "matte."

For "chalk" work, the drawing is first French chalked over, then in order to prevent "thickening" it is preferable to give it a weak "gum etch," in which the gum is charged with a very small proportion of etcher mixed in, according to the character of the work drawn, never more than 2 per cent. This is then washed off, and the plate "regummed-up" with pure gum, rubbing down to a thin film with the gum cloth; or this chalk work may be first gummed-up without this etch being added to the gum. The job is then "washed-out" with the asphaltum solution and the rolling-up done with a good "nap" roller.

In working the nap roller up with the black ink, it is best to slightly overcharge it at first, then to scrape the slab once or twice, and thus bring it down to sufficient supply; this ensures the roller being *evenly charged with ink*.

When proving large "show-cards" or "posters" at the "hand press," and also "panel colour plates," which are usually drawn in pairs upon the one original plate, these necessarily make a big sheet for proving, and one which is too unwieldy for one man to manipulate for "register" by the needle method of "lay," without having recourse to protective devices for safeguarding against smearing of the "inked-up" impression.

This is accomplished by loosely laying upon the inked-up plate a thin sheet of brown paper as "tissue," which covers up the whole of the image, just short of the register marks, which are left entirely free and exposed.

The prover, with the aid of an assistant, now needles into register his proof sheet upon the plate; when this is secured, the assistant deftly draws out the "tissue" from between the proof sheet and the plate, the "prover" all the time retaining a firm grip on the register points, so as to keep the sheet dead true to

"A REVERIE AT THE BROOK."

CHALK DRAWING ON ALUMINIUM PLATE.

PRINTED ON "CORDELIA" PAPER SUPPLIED BY MESSRS. JOHN DICKINSON & CO. LTD., CROXLEY MILLS, WATFORD.

[*Printed by Garden City Press Ltd., Letchwo*

register; he then withdraws the needles, and lays on his backing sheets and glazed "shalloon" board, and then proceeds to make the impression.

Each successive progressive proof sheet after being printed, is laid between large tissue sheets, so as to prevent contraction as much as possible, and at the same time preserve it from dust and dirt until it is again required for the next colours, when the same operations are again gone through.

Another important factor in connection with proving new work from the plate is the *class of roller* used for proving purposes. The easiest washed, colour proving roller that is used for this work is a *gray rubber skin*

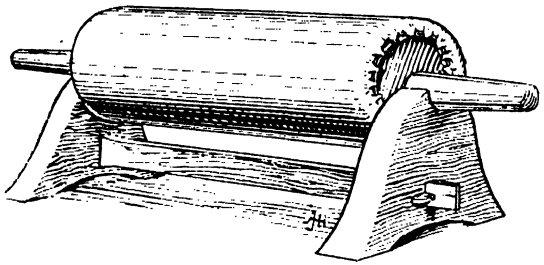


FIG. 18.—ROLLER STAND.

one, drawn over a tightly covered hand roller stock; a ply or two of seamless, tubular flannel, as made by Horsell's, is first fitted on and drawn taut on the wood shaft of the roller and securely fastened at the ends. The protruding loose fibres of the flannel are carefully singed from off it, by passing it speedily through a gas flame.

Next, some French chalk is dusted upon the surface of the affixed flannel, and then the outer rubber cover is drawn tightly on and laced at the two ends, similar to what a leather roller skin is done.

This form of attachable rubber cover is far better than the solid rubber core method, as cast immovably on the roller stock, as it does not become uneven

through contraction in parts, as what the solid form of rubber roller does, in which unlevel condition it makes it very difficult to roll up a job evenly, without having to undergo extra inkings-up to compensate for the shortcomings of the depressed parts of the rubber, which, on account of these hollow places, fail to take up ink there properly from the ink distribution slab, or to be able to impart it again to the work on the plate.

With the detachable "rubber cover" roller, however, there is no such trouble, as the thickness of the rubber skin is not sufficient to admit of any appreciable irregularity like what the solid one displays.

The only trouble that is likely to ensue with this form of roller is that of the flannel packing wearing down with use, in which case the rubber cover is drawn off, and new plys of flannel covering put on as before, when the roller is as good as new.

With proper care a good roller can be kept in use for a year or two without the need of re-covering it.

This form of hand roller then is far away the best for "proving" or printing colour work from the plates, when compared to the glazed skin roller or the solid rubber one; but a reservation must be made in favour of *colour "nap" rollers*, which are pre-eminently suitable for plates, but in which case it is advisable and politic to possess a set of them, reserving one for red colours, one for blues, and one for black, etc., which, of course, involves a greater outlay for equipment at the outset. At the same time it must be admitted that the nap roller, with its velvet-like touch, is the best, and is more sympathetic to the metal plate surface than what the best rubber roller is, especially from the point of view of delicate "rolling up," firmer grip, and of the preservation of the rough grain of the plate, which are very great considerations where the very best class of work is being done and the most perfect results sought for.

CHAPTER IX.

"Reversing" work from Right to Left View.

"REVERSING COPPERPLATE TRANSFERS—"WAFER" PLATE METHOD—"TINFOIL" METHOD OF REVERSING —"PHOTOGRAPHIC METHOD OF REVERSING"— "MECHANICAL REVERSO METHODS"—"PROVING" BY WOGDON MACHINE—"TRANSPOSING" BY VARIOUS METHODS.

This is a process in metal plate work by which we can form a "pair of pictures" possessing divergent lateral views from the one original, without having to redraw the reverse view—in other words, changing over the view of an illustration from right to left prospect.

Therefore if a design is drawn with a "left" lateral view, we can make a "right" lateral view image direct from it, and at a mere fractional cost of time and material that would be involved in its redrawing.

This reversing process is extremely useful in connection with rubber offset work.

Again, instead of drawing a full, complete border of any design or subject, we can by this process build up from a small corner section a *complete square* or *rectangular border* reproduction of the original small angle section.

There are a number of ways of doing this work, the most common one being to pull a transfer from the plate or stone of the subject that has to be reversed, then to lay this face up upon a smooth stone in the hand press, and then to place another piece of transfer paper face down upon it, and pull through the press under a good pressure. The top sheet of transfer paper will have taken up under pressure sufficient ink

from the first piece to enable it to go down to plate as a "reverse" transfer, along with the one from which it was taken, and thus to form a "right" and "left" pair (as in Figs. 19 and 19A), which can be worked from in the ordinary manner.

For this stripping purpose, Lorrilleux's Everdamp

FIG. 19.

FIG. 19A.

transfer paper "Hydrochine," or Horsell's "Kesmoi," are excellent papers to use.

"REVERSING COPPERPLATE TRANSFERS."

For copperplate transfers, pull the transfer upon Scotch plate transfer paper, then lay this face up upon

a smooth steel plate possessing bevelled edges. Next lay another piece of slightly moistened plate paper upon it, and pull through the copperplate press; then strip slowly after warming over a copperplate heater: it is then ready for transferring for the offset machine.

"Wafer" Plate Method.

A very novel method of reversing is to employ *thin supple sheets of zinc*, known as "wafer" plates, in place of transfer paper for taking a transfer image direct from the original stone or plate.

The original stone is rolled up with retransfer ink to which a few drops of Oleic acid or Elbagreen oil has been added. The "wafer" plate is then laid carefully down over this inked-up original, and then the backing sheets and shalloon board follow on, and the impression is next made.

This wafer plate is then separated very slowly from the original, and is then cleaned-up and etched, etc., when it becomes the new original from which transfers are pulled for making up the printing plate.

Both Messrs. Horsell & Co., of Leeds, and Algraphy Ltd., of Peckham, London, stock "wafer" plates which are specially adapted for this work.

This method enables slightly sharper transfers being obtained than the paper method.

"*Chalk work originals*" are best reversed with the Everdamp transfer paper method.

"*Engravings upon stone and plate*" are also best reversed with this Everdamp transfer paper.

"Tinfoil" Method of Reversing.

Reversing is also done by means of sheets of tinfoil paper by pulling a transfer ink impression upon it; then afterwards placing a piece of Everdamp transfer paper face on to the tinfoil impression, and pulling both through the press together under good pressure. The transfer is then "stripped" slowly from the tinfoil, when you have a reversed transfer, which is run down as usual.

Sheets of dull enamel chromo paper are also used for producing "reverses" or "right to left" view transfers, but are generally used as the stripping medium in taking the reverse from the transfer paper.

"Photographic Method of Reversing."

We now refer to a very accomplished method by which this reversal of image may be produced, and that is the photographic method.

By this method both the reverse and original images may be either *enlarged* or *reduced in size*, according

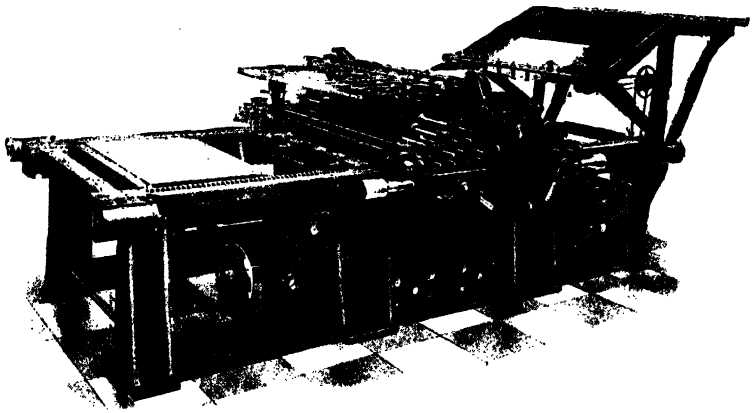


Fig. 20.—Wogdon Machine.

to the requirements of the work: whereas the other methods limit the reproduction of a *fac-simile* size only.

First a negative is made with a PRISM, and then another one without either prism or mirror. Wet plate negatives are the most perfect.

These films are then stripped and mounted in position upon a sheet of glass or celluloid, and utilised upon a sensitised zinc plate for producing the image.

"Mechanical Reverso Methods."

In addition to the afore-mentioned photographic and hand methods of reversing, there is the mechanical

reversing methods, in which a specially devised and constructed machine or press is utilised for producing this inversion of transfer. The "Wogdon" (Fig. 20) is one of these machines, and has proved very efficient in this work. Other types of reversing apparatus are made by Messrs. George Mann & Co. and Messrs. Penrose.

The method of producing the "reverse" in some of these appliances is as follows: The stone or original plate is set for pressure in the bed of the reversing machine, and the work inked-up with retransfer ink. An impression is then made upon the rubber clothed cylinder. Next a tympan is laid upon the stone or plate, and the cylinder pressure readjusted to correspond wih the thickness of the tympan. The transfer paper is then laid in due position to accept the impression from the rubber, or it is fed into the grippers of the machine coated side to the impression, and the reversal then made.

"Proving."

The "Wogdon" machine is also utilised for *proving* offset work where the original has been drawn expressly for offset work, as by proving it direct in the ordinary hand press the lettering and inscriptions would read from *right* to *left* instead of in "reverse."

"Proving" is also done upon the Mann reversing press.

We may here remark with regard to type, that a number of the type founders now cast various fonts of type the reverse way of view, as an accommodation for rubber offset requirements. This saves the transferrer the trouble of reversing it.

"Transposing from Black to White, or Negative and Positive Image Production."

By this process in metalithography we can transpose type and written lettering, or any "line image" and "stipple design" from black to white effect, the

original white surrounding background, of course, being at the same time made black. (See illustrations, Figs. 21 and 21A.)

The following are a few of the best methods of accomplishing this work, both on zinc and aluminium plates:

"*Oxalic Method.*"—For *transposing upon aluminium plate*, first pull an impression of the job upon

FIG. 21.—SPECIMEN OF TRANSPOSITION (POSITIVE).

FIG. 21A.—SPECIMEN OF TRANSPOSITION (NEGATIVE).

a smooth surfaced transfer paper, then dust this over with finely pulverised *oxalic acid powder*. This is then run down upon a plate that was previously inked-up thinly all over with litho. transfer ink, a damp backing sheet being used. The repeated pressure upon the acid powder forces an entry through the ink film; water is applied and the plate carefully washed under the tap; then touched-up, gummed, washed out, rolled-up, chalked, etched, and gummed, when it is ready for use.

"*Photographic Method.*"—The most perfect method, however, both for zinc and aluminium, is the photographic one, in which a negative is first made, then a positive made from this by contact; this transparency is then used to produce the negative image upon the plate by means of direct photo-lithography.

If both the positive and the negative images are required to appear side by side in the print, then the photographic films are stripped and remounted together upon one glass, and thus utilised for direct photo-lithographic methods in producing the printing surface.

"Wet plate" negatives give the best printing results, and should be made with Messrs. Mawson & Swan's Collodion.

"*Gum Arabic Method.*"—*Another good litho. transposition method* is to pull an impression on dull enamel paper in firm black ink—of the job that has to be transposed—and to then dust it over with pulverised acacia (finely powdered gum arabic). Place this in the damp book to mature, so that the particles become just adhesive. Then lay down upon the plate and pull through the press once under good pressure; strip off the paper, and fan plate dry. This should now have given a *gum transferred image* upon the plate.

Next pour some asphalt washing-out solution all over the plate, and rub down to a thin film: this will form the solid background.

Now dissolve off the gum image, when those parts of the plate become clean metal. The work is then treated as an ordinary transfer in making ready.

"*Desensitised Surface Method.*"—The following is a very popular method of metalithographic transposition. Take a perfectly clean zinc plate and etch it with a good, reliable zinc etcher; then gum it up, and fan dry. This should be repeated a second time for safety.

A black impression is then pulled from the original, upon oak varnish transfer paper; this is then laid in position upon the plate, and pulled through the press in the ordinary way. Remove the varnish paper with-

out using any water, then powder up the ink image thus transferred with Colophonium powder, finishing off with French chalk.

This layer of resin powder is now heated over a copperplate heater, until it fuses with the ink, when it assumes a dark, black shiny appearance. The plate is then cooled with water applied from the back. The work is now once again powdered and heated. Any dirt present must be removed by means of a wood pencil and dry pumice powder.

The plate is now immersed for a couple of minutes in a " resensitising " bath (alum acid), and then well washed with clean water.

After drying it is coated with lithographic writing ink, or it may be spread all over with asphalt washing-out tincture. When dry, wash the plate over with turpentine and water, and roll it up with black ink and nap roller, when the reversed image will appear as clean and sharp as what the transfer was. French chalk, etch, and gum-up, when the transposition is completed.

CHAPTER X.

"PHOTO-LITHOGRAPHY"—"PHOTO-TRANSFER PAPER METHODS."

THE ORIGINAL PHOTO-LITHO. TRANSFER PAPER METHOD —VARIOUS KINDS OF PREPARED PAPERS—FORMULAS AND RECIPES OF THE PROCESS—MANIPULATIVE DETAILS —TRANSFERRING OF THE BICHROMATED GELATINE PHOTO-LITHO. TRANSFER PAPERS —PRINCIPLES AND LAWS OF PHOTO-COLLOIDAL BODIES.

The oldest and most general process of photo-transfer paper lithography is that known as the bichromated gelatine method, in which sheets of soft sized paper are coated with a smooth film of organic matter, such as gelatine, albumen, or gum arabic.

This organic substance is rendered sensitive to light by being saturated and impregnated with a solution of bichromate of potassium salt.

When dry, this paper is exposed to light under a "line" or "half-tone" negative; and then the surface is inked-up with a thin grey film of "litho. retransfer ink," thinned down with "turps" or "lavender oil."

After allowing a few minutes for the volatile oils to evaporate, the image is *developed* upon the paper, by immersing it in a bath of lukewarm water.

Lightly rubbing over the surface of this photo print with a pledget of cotton wool hastens the development by clearing the image.

These plain gelatine coated papers can be purchased from the supply houses—such as Penrose's, of London —prepared ready for "sensitising."

"Jaffe's" Eagle Brand, or "Albert's" Ordinary, are used for "line" work; and "Husnik's" Auto-

typie, or " Albert's " Autotypie, or " Jaffe's " Brilliant are best for " half-tone " work.

We have also successfully used for this purpose a weaker coated paper such as " Illingworth's," or " Autotypies " carbon double transfer papers.

After cutting the quantity of sheets required to the size of the negative being employed, this paper is then " sensitised " in the following bath :

Potassium Bichromate	1 oz.
Water	1½ pints
Liquid Ammonia	about 8 drops

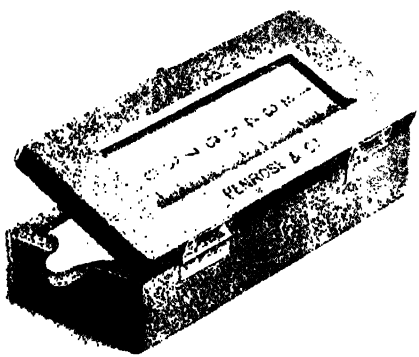


FIG. 22.—ACTINOMETER.

Immerse the sheets singly in this solution, coated side up, keeping the surface free from air bubbles. They should be retained in the bath for one minute, the temperature of which should be about 62 deg. Fahr.

On removing the sheets from this sensitising bath, they should be squeezed down to a Ferrotype plate, and dried as quickly as possible in a warm, dark room or drying chamber. When dry, they are sensitive to light, and should be used within a couple of days, otherwise they deteriorate.

Exposure.—Place the negative face up in the printing frame, and then the coated surface of the bichromate paper direct upon it; and then fasten up tight for complete contact. Expose to light in the shade until an olive fawn coloured image is produced. It is best to use an Actinometer as a guide for correct exposure. Fig. 22.

The print, when removed from the frame, is held at one edge upon an "inking-up board," and is then

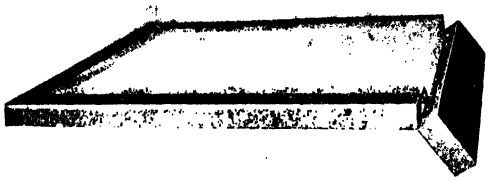


FIG. 23.—INKING-UP BOARD (PENROSE & CO.).

inked-up all over its surface with a thin film of lithographic retransfer ink, previously thinned with "turps," "lavender oil," or "poppy oil," and applied with a letterpress composition roller, or failing that, then by means of a rubber roller.

Another method by which this paper may be inked-up is to first roll-up the smooth polished surface of a lithographic stone with a layer of this ink; then placing the photo-litho. transfer print face down upon this, and pulling it through the hand press under a fair pressure. This procedure transfers a film of ink from the stone on to the surface of the transfer paper. The stone may be re-inked, and the paper laid on in another place so as to guarantee that the transfer paper shall have taken up an even film of ink all over its surface.

After waiting a minute or so for the turps, or other volatile oil, to evaporate out of the ink, the inked-up

print is then immersed in a dish of warm water to effect the development of the transfer.

In about two or three minutes' time the unexposed portions of the paper surface—or those portions which were protected by the opaque parts of the negative—being still in a soluble state, they slowly dissolve away, and upon the application of a pad of moist cotton wool the print develops quite clear of the superfluous ink, leaving the lines of the image sharp and evenly charged with a thin grey film of transfer ink.

A final rinse under the tap frees the paper of any loose particles of gelatine, or other foreign matter, and completes the development procedure.

It may be here emphasised that the ink upon this transfer image must not look black, but *grey*, as a black impression is the sign that there is too much ink upon the transfer, which will thicken the image in the transferring.

Theoretically the print is now ready for the transferring, but in practice it is found to be best to first dry it.

These photo-litho. transfers are not now sensitive to light, so may be hung anywhere to dry, provided they are kept free from dust.

When dry, they are matured for moisture in a damp book, just as what commercial work transfers are, and are then transferred down to the metal plate, after having set it into position upon the plate bed and adjusted the pressure in the transfer press.

A few dominating points in connection with the transferring may be here noted.

In running these photo-transfers down to plate, great care has to be exercised that the transfer does not "slide" or "skid," as it is technically termed; therefore the controlling pressure and moisture must not be more than of moderate amount, as extremes would ruin an otherwise fine transfer.

In order to safeguard against this "skidding," and to enable the transfer being run through under pressure a number of times, and also to compensate for an

uneven or irregular tympan, the following method should be adopted, which will ensure a perfect transfer being obtained:

Apply light pressure only for the first pull through, which enables the gelatine surface of the paper to get a safer grip of the plate without the danger of the paper "sliding," and at the same time allows the plate to absorb some of the surface moisture from the transfer paper, and thus affords this latter material a firmer anchorage upon the printing surface.

After the first pull through has been properly achieved, then a few more additional pulls through are given, so as to release every vestige of ink possible from this photo transfer paper, and thus effect its firm transmission to the plate.

As with other classes of transferring, the plate may be turned round between the runs through, so that the ends are reversed for the subsequent pulls through; this compensates for any unevenness, either in the tympan or press scraper, and ensures uniformity of transfer.

When the transfer is a large one, with coarse work, the plate may be treated with a preliminary wash of turps, applied with a pad of cotton wool. This method, however, has the effect of producing thicker transfers and less smart work.

As soon as this photo-litho. transfer paper is peeled from off the plate the surface should be washed with some clean warm water, to which is added a small quantity of gum arabic solution for the purpose of preventing any scum arising.

The plate is then chalked and gummed up properly, and the usual procedure of making ready for use is carried out.

If the transfer is put down to an aluminium plate, then the work may be rubbed up before rolling-up is proceeded with.

Should the transfer be a stale one, or the paper uneven and "cockly," the following method of transferring may be adopted: Take a sheet of ordinary transfer paper slightly larger than the photo transfer,

and moisten it in the damp book until "tacky." It is then laid completely over the back of the photo-litho. transfer, and pulled through under pressure. The outcome of this is that this ordinary transfer paper, being of a very adhesive nature when moist, at once clings tenaciously to the plate, all around the exterior edge of the "photo transfer," and also all over the "back" of it, and thus holds it in secure position upon the plate, so that it may be pulled through an unlimited number of times, and thus absolutely ensure its going down perfectly.

An alternative of this method is to cut tiny apertures in the photo-litho. transfer wherever the character of the work will permit of it amongst the blank portions of the image; then when the pressure is applied during the transferring, those overhanging portions of the backing sheet of transfer paper are forced through there on to the plate, giving an additional anchorage or grip-hold upon it, and affording the utmost security against "doubling" or "distortion" of the image during the running down of the transfer.

This has proved to be a most infallible method, even with the most "refractory" and "stale" transfers, and may also be applied for "autographic circular" work as well, with great advantage.

There is another manner in which this bichromated gelatine photo-litho. transfer paper is utilised in metalithography, and that is by preparing the gelatine and bichromate salts as a single emulsion, and thus both coating and sensitising the paper at the one operation. Photo-litho. paper prepared in this form and kept "air tight" will keep fit for use for a month.

In addition to the "bichromated gelatine photo-litho. transfer paper" process as just described in the preceding pages, there is another one known as the "*Amphtype*," and "*Identographic*" *photo-litho. transfer paper process*, in which a "Baryte" coated paper is sensitised with gum and a ferric salt.

This paper is ever ready for use, but is more delicate and variable in its working than the gelatine paper,

due in a large measure to the " Baryte " coating being so variable in the different batches of paper supplied. It was invented by one of my old students of the Liverpool Municipal Technical School.

Before dismissing these " photo-litho. transfer paper methods," it will prove most helpful to the tyro in these matters if we briefly explain the underlying principles and reactions which are involved in the operation of them.

The theoretical basis, along with the natural phenomena which dominates in connection with the practical working of the " Bichromated Gelatine photo-litho process," forms the " Key " to all the other photo-reproductive processes. So that, if the student of them masters this one, and obtains a clear and intelligent conception of what transpires in connection therewith, he has secured for himself an entry into the comprehension of the reactions of all the others, and thus paved the way for easy and certain success in succeeding methods.

At the outset, then, we have to recognise that *light* performs a spontaneous, natural work, upon all *organic* substances. Upon some of these substances, this natural action may be varied, and accelerated, and made to appear much more pronounced, by introducing into them certain chemical substances, which will in part enter into the new compounds formed by this remarkable force of " light action."

What occurs, then, in actual practice in connection with this photo-litho transfer process, is, that certain organic matter, such as " Gelatine," or " Albumen," or " Gum," having mixed with them a solution of a bichromate salt, such as " Potassium Bichromate," or " Ammonium Bichromate "; this organic matter thus treated then becomes, when dried, remarkably susceptible to the action of light; due to the presence of the bichromate that was mixed into it.

To demonstrate this principle more explicitly, supposing a portion of this mixture was placed in a dark cellar, say for six months, and was then redissolved,

having been kept protected from active light during the process; we should recover the gelatine again in the same state as it was when we started with it, and we should also have the bichromate salt as before; no appreciable alteration or change having occurred in either of these two substances.

But now, on the other hand, if the remaining portion of this mixture of "Gelatine" and "Bichromate of Potassium" were spread upon sheets of paper in the form of a thin film, and then dried in the dark, afterwards exposed for a few minutes to "light," we should then notice that a most remarkable change had taken place, both physically, chemically, and virtually.

We could no longer "wash" the bichromate substance away from the gelatine; these two substances have now become *inseparable*. They would no longer exist in the form of a *mixture*, but would now be in the form of a *compound;* entirely different to their original, and separate characters, and capacities.

In the first place, we should find that this substance was now *insoluble* in water, that it was *hard* and *horny*, that it had changed its *colour*, that its *smelling capacity had gone*, and that it retained greasy ink upon its surface with a fair amount of tenacity. "Light" had done its work: what that work is, is still a matter of theory only.

Thus we should distinctly observe that this organic matter had been rendered very sensitive, and susceptible to light action, by the presence in it of the bichromate substance alone. No action, however, ensued with the simple mixture of these two substances, when kept away from light. It needed "light force" to compel the change: hence the whole principles of photo-lithography depend upon this simple law, and this simple reaction.

Having, then, considered the principles and natural laws involved in this reaction, we can now better follow out the exact procedure of the process in conjunction with a negative, in the reproduction of a given image.

In reproducing a "line" illustration such as a *plate engraving*, or any black and white illustration in "line" or "stipple," we have a negative consisting of an image in black, with clear glass spaces intervening. These *clear blank spaces* represent the ultimate black lines of the illustration; it is through these clear portions that the *light* passes on to our photo-litho transfer paper lying beneath them. This light then does its work there as we have already observed in an earlier indication, by making these parts hard and insoluble, and converting the mixture there into the compound state.

But the "black opaque parts" of the image, which intervene between these clear lines of the negative, obstruct the passage of the light to those parts of the sensitive paper lying beneath them, and thus they still remain merely a mixture, unchanged, chemically and physically; so that when we apply a thin coating of lithographic retransfer ink upon the surface of this exposed photo-litho paper, and then afterwards immerse it bodily into a dish, or tray of water, those parts alone that are lying beneath the ink upon which light had actually acted, is the image in transfer ink produced, just as on an ordinary transfer, with but slight variations of character: the other soluble portions wash away from the paper.

This explains then in the main the laws which control all the other forms of photo-process light action.

The "Vandyke" process, "Direct Photo-lithography on Metal and Stone," "Photo-gravure," and "Photo-aquatint," "Collotype," "Line Engraving" on zinc, "Half-tone on copper, zinc, and brass," and, in fact, all the general photo mechanical processes, come within the scope and purview of these self-same laws and reactions, plus the particular modifications bound up with each process.

Hence having gained an insight into this one, we can mentally follow the others, even though they may be applied in many diversified forms, and on both the metal and stone printing surfaces.

Photogravure and Metalithography in Combination.—We may here briefly refer *en passant* to the comparatively recent success which has attended the development of rotary photogravure printing, and its influence upon half-tone work and metalithography.

Arising out of this development, assiduous efforts have been made to harness up three-colour metalithography with this rotary photogravure, and already the results attained are very effective.

Thus the general contour of the picture is printed from the rotary photogravure plate; and then three translucent litho. colours are printed on top in exact register to produce the completed combination chromo-metalithographic-gravure.

Both offset as well as the direct methods of printing the lithographic colours have been tried; the offset method, however, is the one most esteemed on account of the thinner film of ink that can be impressed upon the photogravure print, and thus not overpower the more delicate tones of this intaglio print, as well as affording quicker drying facilities in consequence.

We may also remark that *three-colour photogravure* has been tried printed by the rubber offset method of production, the promoters expressing themselves as quite satisfied with the progress made in this direction.

CHAPTER XI.

DIRECT PHOTO-LITHO. METHODS UPON PLATE—RATIONALE OF THE PROCESS AND RECIPES, ETC.—COMPARISON OF LITHO. WITH TYPO METHODS—"INTAGLIO" HALF-TONE LITHO. METHODS—"INTAGLIO" FROM FLAT-BED LITHO. MACHINE.

NOW, although vast improvements have been effected in recent years in these photo-litho. transfer paper processes, as we have just indicated in the preceding descriptions, yet we frankly admit that the DIRECT method of photo-lithography is far and away the best; in which the *plates are sensitised direct*, and the image thus produced direct upon their surface by means of "actinic light action."

We here describe the easiest European method, which is in use amongst some of the best establishments on this side of the globe; and which we have also ourselves employed with never-failing success for a great number of years; besides having successfully trained some hundreds of our fellow-craftsmen into the practice and use of also.

MODUS OPERANDI.

A new, fine grain, zinc or aluminium plate is selected, or an old plate is prepared in the graining machine with a fine grain by means of medium pumice powder, well run down with the porcelain marbles to a state of muddy ooze, so as to keep the grain delicate.

It is then well washed both back and front to free it of any scum of this pumice powder. It is next placed in the "affinitising" bath for about four minutes, removing the black deposit from its surface every minute or so, as formed by the bath action.

It is again well washed with clean water and a soft sponge, when it is ready for the sensitising operation.

Here we employ a *different organic substance* to what we did for the photo-litho. transfer paper, viz., we now use "Albumen" (white of an egg) instead of gelatine. The same sensitising salts, however, are used, viz., Bichromate of Potassium, or Ammonium.

The following is a reliable formula which gives good results:

Albumen	1 oz.
Bichromate of Ammonia	25 grains
Water	8 ozs.
Ammonia .880	6 drops

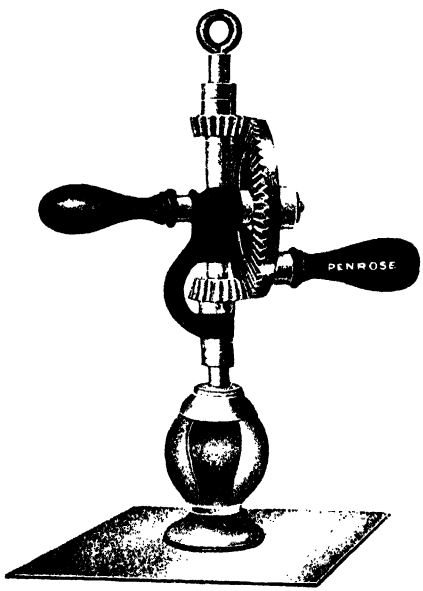


FIG. 24.—HAND WHIRLER.

The bichromate salt is dissolved in half the quantity of the water, the albumen being whisked up in the other half. The two are then well mixed together, and the ammonia finally added, which turns the solution to a lighter or straw-coloured mixture.

It has now to be filtered before use. This is done by

means of a funnel, and a pledget of cotton wool; or a tuft of glass wool acts admirably for this purpose, although somewhat more expensive.

This solution works much better a few hours after it is made, and will continue good for a week or ten days. We have even used it a month old with success, but this is not recommended.

To properly coat a zinc plate with the sensitising fluid, an instrument termed a "whirler" (Fig. 24) is

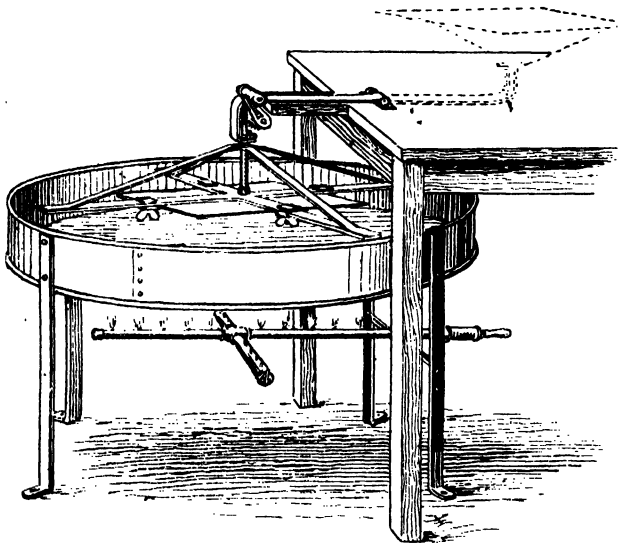


FIG. 25.—POWER WHIRLER.

employed. This is for the purpose of securing a thin, even film of the sensitiser upon the plate, and incidentally to accelerate the drying; otherwise the exposure would display varying results upon a plate unequally coated with this sensitive film.

The zinc plate is attached to the whirler by means of an India-rubber suction bulb for the smaller size of plates; but for the larger sizes, a clamp arrangement is fitted to the whirler (Fig. 25), which holds the largest plate (up to 60 by 40) securely in position during the whirling operation.

The sensitising fluid is poured over the plate and a thin film of it whirled to dryness, in which condition it is sensitive to light. It is then brought into contact with the negative. This latter may be either a " line " one or a " half-tone screen " one; or a " Metzograph " grain screen one may be employed, which latter gives results similar to a grain drawing in lithography if a " high-light " result be attained in the negative.

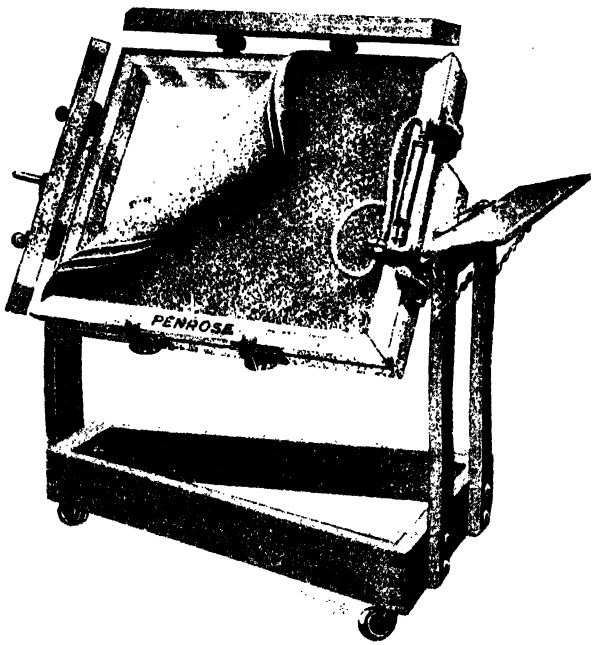


Fig. 26.—Pneumatic Printing Frame.

The negative with the sensitised plate attached is then placed in position in the process printing frame, and perfect contact assured. The pneumatic printing frames are the best (Fig. 26).

It may be exposed to either " daylight " or " electric arc lamps." If the latter, the " enclosed " type affords the most rapid exposure result.

The time of exposure may be anything from three minutes to fifteen, according to the source and actinic intensity of the light. An "actinometer" should be used by beginners, in order to ascertain the correct duration of exposure when using different sources of light power.

The next operation after the exposure is that known as the "inking-in." The exposed plate surface is inked-up with a film of lithographic retransfer ink, thinned down with turpentine, or lavender oil, which is applied to it by means of a composition roller.

Then this inked-up plate is immersed in a dish of clean, cold water, in order to dissolve away the coating from the protected and unacted upon parts of the plate.

To facilitate the development, a wet pledget of cotton wool is rubbed over the inked-up surface of the plate under water, in order to dislodge the adhering particles of soluble sensitiser, and thus to develop the image completely on the plate, and to free it of all the superfluous matter. A final rinsing under the tap with a good flow of clean water completes the photographic side of the operation.

The plate should then be handed direct to the lithographic press hand for "cleaning-up" purposes. The first thing that he will have to do in connection therewith is to examine the image and ascertain if there is any "touching-up" needed.

Should there be any broken lines, or any part of the work at all weak, he will proceed to "touch-up" those parts with either a "sable hair brush" and "lithographic writing ink," or by means of a fine lithographic "pen." The plate is then ready for the gumming-up. After this the procedure of manipulation is precisely the same as with an ordinary transfer. The transferrer washing out the work with the "asphaltum tincture," rolling-up, dusting-in, cleaning-up, etching, gumming, etc.

If the process operator should happen to be a practical lithographic printer, as is now frequently the case, then he would see the work right through himself,

without the need of its having to pass into other hands, and he would know precisely what the reproduction could, and should, give.

The enormous advantages, and remarkable facilities, which the "zinc" and "aluminium" plates offer to the lithographer for "photo-mechanical process work" in his craft is as yet unrealised by the wider circles of

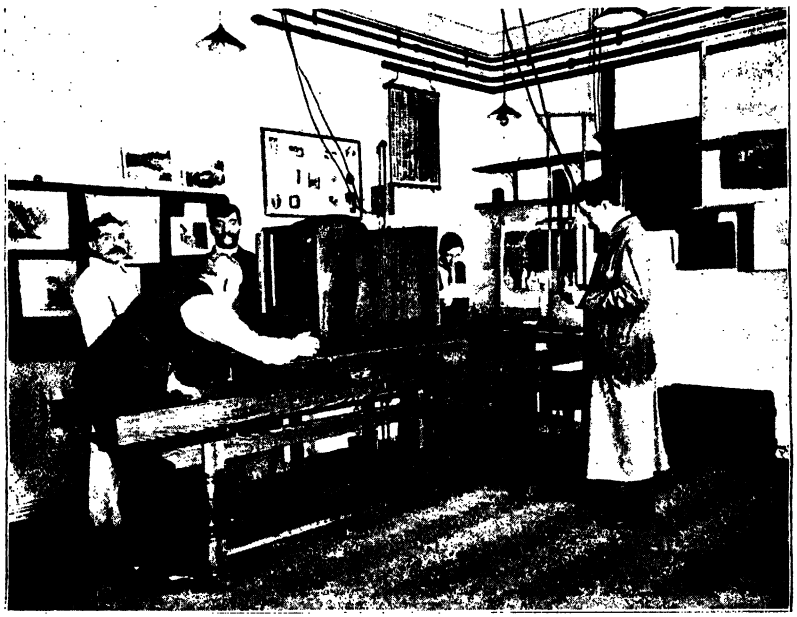


FIG. 27.—CAMERA.

lithographers, who still attach themselves so closely to the stone age methods of their craft.

There is no other productive branch of the printing arts and crafts which is so economic and realistic, as well as potent and artistic, as the century-old planographic method of lithography now is, when fully and properly utilised and applied in photo-process work.

A brief comparison between the lithographic and typographic methods and facilities of an ordinary commercial job, as applied to photo process work, will show

most markedly how lithography scores right away through, from every standpoint, where full advantage is taken of its powers and efficacy.

Let us take, for example, the reproduction of a "pencil sketch"; say, the profile of a man's head, the conditions being that this must be reproduced *facsimile*, or as near as it is possible to obtain this. The order for this job being a million copies of D. C. octavo prints, to be reproduced as a 133 line half-tone screen image, so that the resultant print will appear grey like an actual pencil sketch, although printed in black ink along with text matter in black, also done at the same time.

By "lithography," we should first make our "high light" screen negative of the copy by means of one of the "high-light" camera methods, so that when we printed this upon the sensitised metal plate, we should obtain a half-tone screen image of the original, possessing the pure whites of the copy, all the superfluous screen dots being eliminated photographically, by means of this high-light negative method.

Now, if we were proceeding by "typographic" methods, we should also have to first make a half-tone screen negative; but in this case there would be screen dots in the high-light portion, so that we should have to print upon the metal plate a screen dot, all over the lightest tones of the picture.

This screen dot is, in this relief method of printing, absolutely necessary, in order to prevent the inking rollers from dipping down in those lighter tone places during the printing, which would result in the soiling of the prints in the whites, and thus spoil the impression. Thus the letterpress block could not give pure whites, as it would be next to an impossibity for a router to *cut out* all this superfluous screen dot from the block, without leaving a sharp and disfigured edge all over the picture, which would not be permissible in mono-colour work, as this sudden edge would jar too much upon the eye.

Next they would require to duplicate these half-tone blocks in order that a sheet of at least eight up of these

illustrations might be mounted and worked at the one time.

Now here again in this connection lithography comes out on top. We can pull eight transfers from the original, and patch these up, and run them down, almost in the time that it takes a printer to send his block to the electrotyper for the making of the seven duplicates needed. While his electrotyper is making these seven blocks, the lithographer is well away on with the printing of the job; or by the "Printex" method of photo-transferring we could duplicate these half-tone images any number of times.

The typographer, when he receives the electros, has to perhaps "underlay," as well as "overlay" them; and he may spend at least half a day in his "make-ready," before he gets under way properly with the job for printing.

When he does so, he is confined to the heavy, coated, glaze paper, which is not only bulky and heavy, but costly and unsightly from the glaring gloss which is inseparable from it. It is easily destructible, as, if the least moisture settles upon it, two sheets will annoyingly adhere together, and become injured. A bend made on this paper will cause it to crack; this crack will then in turn break off. This perpetual glossy paper of the letterpress printer has the tendency of impairing the eyesight, and producing astigmatism.

With the lithographer, and his *flat surface printing method*, he is not confined to the narrow limit of this so-called art paper! He has the *whole range* of the paper-maker's stock at his command. He can select a fine matt-faced paper, one that is fairly thin, as well as cheap; one that is durable as well as artistic in character, and light in weight. See the print of a lace curtain done on Grosvenor Chater's "Basingwerk parchment paper"; also the Metzograph print done upon Messrs. Tanner & Co.'s "Hopsack" paper.

In the printing of it, he can secure his 3,000 impressions, or even 5,000, per hour by the rubber offset method, and automatic feeders, and with a richness

and delicacy unattainable by the rival process of typography.

The letterpress man may get his 2,000 per hour, but compare the result. The relief dot has everywhere embedded itself into the surface of the paper, and formed a penumbra around each nuclei dot; so that instead of the ink of each dot being strongest in the centre of it, it has the drawback of being spread out from the centre to the outer margin, with a weakened centre itself.

With the "plano" process of the lithographer, there is none of this; he can print under proper conditions just what his image is on his printing plate.

Then we must not forget that the duplicate electro blocks are never so sharp, clear, and good, as the original from which they have been made. So that a decidedly heavier effect results from this duplicating method of the relief printer.

Nor must the question of cost of these extra blocks be passed lightly over, as it works out to a big item at the usual price per square inch. Especially when compared with the cost of the lithographic transfers, and the great saving of time effected by the litho-method over that of the electro or stereo of the typographer.

The climax of comparison is reached when we examine the two different results attained in the finished prints of the "lithographer" and that of the "typographer." The lithographic print is as near the original copy in appearance as can be secured by any of the known "photo-reproductive printing processes." The "high lights" on the lithographic prints are pure, and unsullied with the superfluous screen dot. They are clear, just as in the original. Thus there is no "high light dot" to mar the purity of the print, and set up a flat effect, and false tones which were not upon the original copy, and ought not to be upon the reproduction of it, yet such is the case with the relief block method of the typographer.

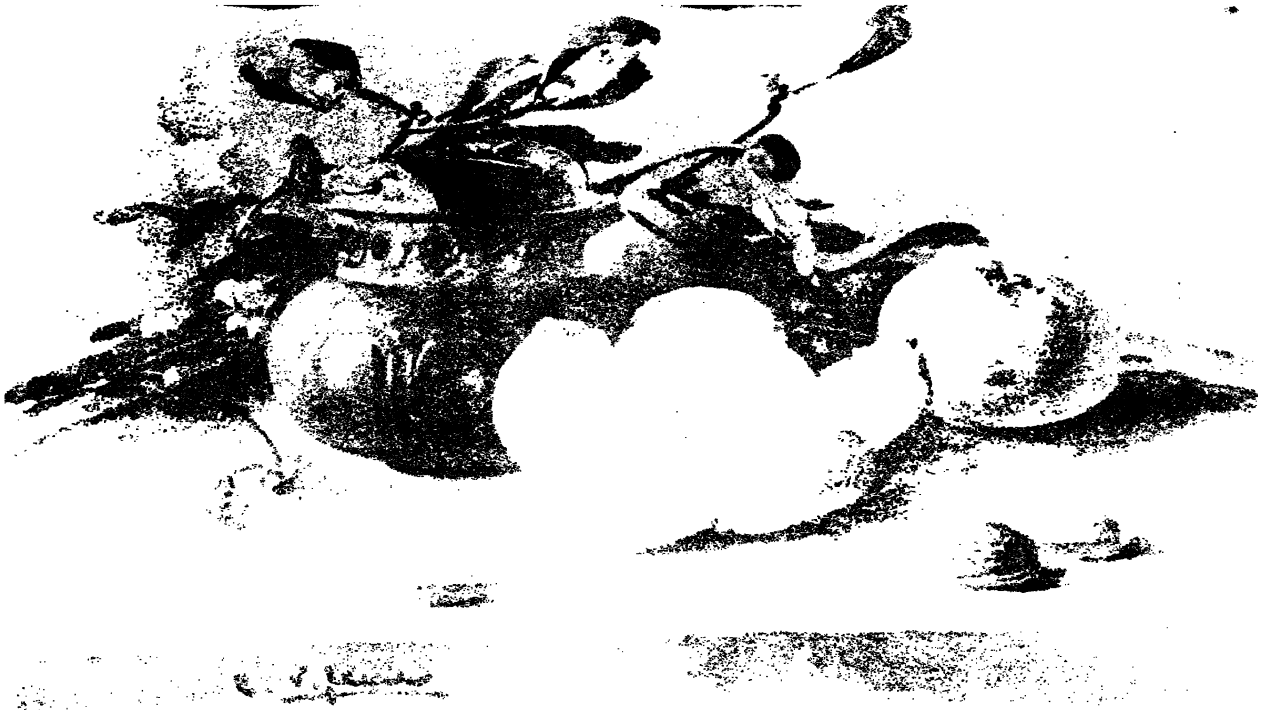
It is true that both the printer and the process

engraver are fully conscious of this screeny defect, and do their best to minimise it by "fine etching," in which the size of the high-light points are reduced to the smallest compass that they will allow of, without breaking away and causing faulty gaps which would display still more markedly the defects of this system. So that the lithographer has the means at his disposal of completely supplanting the typographer in high-class, half-tone, ruled screen work, where both excellence and permanency are the ruling factors of the result.

The foregoing relates to the "cross line" ruled screen pictures, the method which has been humorously described as being "that which compels you to look at the picture as through a sieve." Others term it the "viewing of images through prison bars," on account of the regular dot ruling effect which is the basis of this process.

But there is another screen method which still more caters to the lithographer than it does to his trade confrère, the typographer; and that is the one known as the "Metzograph Screen Irregular Grain" method. Here the picture is reproduced in a grain which is irregular in character, like a collotype grain, or approaching that of a hand-made chalk drawing in lithography. So that when employed in the photo-reproduction of a picture for lithographic printing, produced by the high-light methods, then there is obtained the most perfect result from a photographic basis that is afforded by any of these "screen" methods; and one which is being more extensively employed every day by both Continental and English firms. Especially is this planographic facility the case in connection with process colour work in lithography done from metal plates, where frequently supplementary hand-work is drawn upon the image, adding additional force and character to it.

It is hardly necessary to here point out that the typographer cannot make use of these processes as can the lithographer, due to the aforementioned drawbacks



EXAMPLE OF MEZZOGRAPH HIGH LIGHT HALF-TONE SCREEN WORK.

of the relief method of printing as involved in typography, compared to the planographic methods of the lithographer.

It must not be forgotten, either, that the lithographer has at his command an " intaglio " adaptation of this irregular method, as well as of the regular screen one.

This intaglio method is employed in two different forms: one, as in the form of an " original," the other as an " actual printing surface " itself. Taking the former first, here a photo-mechanical screen image is made in " intaglio " form upon a copper plate, so that the lithographic printer pulls his transfers from this with copper plate ink, just as he does from an ordinary engraved plate in commercial lithography. Any number of these transfers may be pulled, and then patched up in position for transferring to a machine plate, either zinc or aluminium, for printing from. Thus sharp and clean transfers can be procured in unlimited numbers, and virtually as clear and vigorous as the original.

This copper plate original is made by first producing a high-light screen positive, or by painting out the high lights upon an ordinary screen negative, then sensitising a small sheet of smooth 14 or 16 B. W. G. copper, employing the usual Fish Glue sensitising formula for the coating. The enamel image is then printed upon the copper through the positive photo-plate; next dyed-up and developed with water in the usual manner. It is then " burnt in," and finally etched intaglio with the " perchloride of iron " bath as in ordinary half-tone work.

Where an increased range or intensity of shadow is desired, this may be attained either by " local etching " of those special parts after the general " contour " etching is accomplished; or " hand tooling " of these parts may be resorted to instead.

The plate is then ready for the lithographer, who treats it as an ordinary copper plate, and thus pulls from it his " half-tone " or " metzograph grain "

transfers *ad. lib.* as with orthodox intaglio line copper plates.

There is, however, one modification which we strongly recommend to be adopted when pulling transfers from this half-tone copper plate original, for both zinc and aluminium plates; and that is to make the copper plate transfer ink more soft than is usually employed in plate transfers for stone work. This is done by mixing with it one-third of ordinary "stone-to-stone" retransfer ink. It must be thoroughly incorporated with heat, well mixing the two together while in the molten state, taking care not to "char" it with excess of heat. This affords a much better transfer to metal plate being made, than when a more brittle plate ink is used.

Transfers can also be pulled from these plates by using the soft ink as employed for "pewter plate" transfers, as is done by "music" printers in lithography. Even ordinary retransfer ink as used in everyday lithographic work will afford transfers also from these plates; but these inks are rather more troublesome and difficult to manipulate with these intaglio plates, especially in the cleaning off from the surface, of what will otherwise become "scum" on the printing plate when transferred. So that from the foregoing it will be plainly seen that lithographic printers have here at their command a most useful and valuable photo-process method for "metal plate printing" and "rubber offset" machine work.

Now, as to the other method (No. 2); that of making an actual "intaglio printing surface," to be worked in the lithographic printing machine. It might be said by some that this is hardly a pure lithographic method, as the image in this case lies below the common surface, and not level upon it. True, that is the case, but nevertheless the lithographic principle is still involved, as the common surface of the plate above the image has to be kept "moist," so as to reject the greasy printing ink, just as is the case when both "image" and "lights" are on the *same identical plane*, as in

ordinary lithography. In this "intaglio" method a thicker zinc plate than usual is employed; the image is photo-transferred upon it, as in the preceding method, and then etched into the plate in "intaglio" form as before. Here, however, another difference comes in, apart from the use of "zinc" in place of copper.

The lithographic printer inks up this "intaglio" plate with his "nap" inking rollers and greasy printing ink, just as he would an ordinary zinc plate; as he has to keep the plain parts of this plate well supplied with damping water, so that they will reject the greasy ink from the inking rollers, precisely as is done with the ordinary zinc plate of the regular methods.

Hence, the only real difference lies in the fact that his image is eaten deep into the plate, instead of merely lying upon its surface, as in the orthodox manner of everyday lithography.

For ordinary "Flat-bed Reciprocating Machine" printing, this method affords results which—for certain classes of litho. work—are a great advance upon the older method; inasmuch as when each sheet is being printed a larger film of ink is drawn from the plate to form the printed image upon the printing paper. Hence the prints possess a greater depth and vigour than what is ordinarily obtained from the purely planographic method alone, since the same volume of ink is not permissible here in this latter method.

The ink image in this "intaglio" process being etched deep down into the plate surface, enables a larger volume of ink being carried there, so that each sheet of printing paper as it comes into contact with it during the printing operations, pulls away from these photo engraved lines and dots a fuller and deeper film of ink; hence the image stands up as it were upon the paper surface, producing a "halo" or "shadow" effect from the sides of these raised ink image lines.

This reflection gives a "verve" or "burr" effect, which other ordinary printing does not afford.

Thus the lithographer has here again another

interesting and useful acquisition as a master process of his craft.

We need only remind our practical lithographic readers that this incised printing image is just as durable as is the relief one; as the common surface of the plate would here have to be worn away, before any apparent injury to the work could possibly take place.

So that we firmly and unequivocally aver that lithography can, and does produce photo-mechanical printing, not merely equal in merit to that produced by the typographer, but immeasurably better from every point of view, when full advantage is taken of all the facilities and peculiar powers which are now an inherent and integral part of his trade, when working from a " metalithographic " basis.

So suddenly has the " rubber offset " printing process been ushered into the lithographic craft that not one-half of the capabilities and possibilities surrounding it have as yet become generally known.

This is true at the present time of writing in connection with both the " Vacuum " and the " Printex " photo-transfer processes of the craft; each possessing their own particular and special features of service to the lithographic industry.

In the important phase of " DOUBLE-TONE " printing methods, but few firms have as yet gained an insight into the practical mode of accomplishing this class of work; yet the effects to be acquired from it are most beautiful and valuable, and easy of attainment once the insight is gained of the underlying principles and their application.

We disclose below some of the methods we have ourselves employed with the most successful results, and which we know many of our confrères of the craft in Great Britain and the Colonies will be willing and pleased to put into effect themselves.

Some typical examples of this work we produced a short time ago, and which appeared as a pictorial supplement in the monthly trade journal, *The Modern Lithographer*, so that those who care to avail them-

selves of inspecting the same, may see the full effect that can be attained by these methods.

There are two distinct ways in which this " double-tone " printing effect may be done : (1) by a " single " printing method ; and (2) by a " double " printing one of flat tint developing capacity.

The former affords opportunities for a most striking and varied result, as the double-tone may be of a distinctly different hue to the basic colour, and may be either vigorous or delicate, according to the character of the work, and the taste and effects desired.

To express these attainments more explicitly, we may take a " line " and " stipple " illustration or design, which we print in a rich photo brown, body colour, and then spontaneously produce the attendant double-tone effect in the form of a pleasing lustrous emerging fringe of tint, which imparts a warm glow to every line and dot in the print, yielding a mellowness and evanescence of effect unattainable by any other method.

This result is attained in this particular method without depriving the print of its white paper background for contrast, and without giving a flat total tint surround to the picture.

CHAPTER XII.

DOUBLE-TONE PRINTING METHODS FROM METAL PLATES—SINGLE AND DOUBLE COLOUR PROCESSES—FORMULAS AND RECIPES.

Now, in the other example of this double-tone work we produce by means of a second flat tint printing, a complete "halo" or "penumbra," surrounding every side of the lines, and at the same time produce a tint accompaniment, which subdues the contrast of the white paper setting, by introducing a matured Oriental tone of paper background upon which the actual image appears, the result of which is distinctly different to the preceding effect attained.

Both of these methods, however, are a valuable asset in connection with high-class photo process metalithography, as affording an expression in printing, which is not only a novelty, but which possesses also a marketable utility, and enhanced range of delineation.

Dealing then with the detailed manipulation of this latter method first, that of producing a complete "universal double-tone" effect upon printed work, by means of a second printing; we commence by selecting an uncoated plain printing paper, machine wove, feebly or soft sized, yet of a substantially stout character for preference.

Our next consideration is the ink, and the character of the work upon the zinc or aluminium plate from which we have to work the job.

Assuming that our subject is a "line" design, comprising both fine and heavy lines, we prepare our printing ink for this—that of a photo brown shade is most suitable—by mixing together some burnt umber litho. ink, burnt sienna, scarlet lake, cochineal lake, and the veriest touch of black.

We discard in this, both strong and mid. varnishes, reducing it down to a working consistency with a mixture of vaseline, glycerine, diachylon, beeswax, thin lithographic varnish and sperm oil. No dryers whatever of an oxidising nature, such as "copal," "gold size," "litharge," "boiled linseed oil," or "siccative," is introduced into this body colour at all.

The work is printed as clear and sharp, as well as firm and solid, as it is possible to accomplish; just as it is, or should be, the aim in the everyday printing of lithography. So that anyone examining the effects of this first printing would observe nothing out of the ordinary appearance of lithographic work, there being neither shine or glaze upon either the fine lines, or the heavier shading.

The second printing for the production of the double-tone effect can be proceeded with the next day.

This is done by filling in a "solid" upon a zinc plate, which will completely cover over the range of the first printing, allowing a sufficient margin top and bottom to show off the remainder of the paper surface when printed upon.

This solid has to be printed as a second printing in a tint ink all over the previous printed work, with this proviso, that it has to be mixed in the special manner herewith described, so that it will produce the "double-tone" which it is its mission to effect.

This is accomplished in the following manner: First mix up a tint base, by means of some "Mid. Lithographic varnish," and some "thin varnish." Then add some "olive oil," and a small quantity of "vaseline," next a small proportion of "paraffin oil," and "lavender oil," to which a touch of sil. soda was added. The colouring matter is next added, only a very small quantity being necessary. A touch of Raw Sienna, and Orange Chrome, or a touch of Raw Umber and Vermilion will afford a Buff tint of a satisfactory and adaptable hue for the body colour already cited above.

When this tint is printed solid upon the previously printed work, done in the photo brown ink, as already

specified, it will be found that it at once commences to affect the printed ink of the image. It first causes it to assume a gloss, then it will be noticed after a short time, that there is a faint tinge of colour beginning to percolate from every particle of the printed image; this tinge when completed, forms the "double tint" or "halo," which is the very essence of a pleasing atmosphere thus imparted to the printed work; and in this example is the manner in which this form of "double-tone" is accomplished.

Although a "line" image, or job, was here specifically referred to as the concrete example of our illustration treated with the formulas and methods described in the preceding method of "double-tone" printing from metal plates in the lithographic manner, we wish to state that "half-tone" images, whether of the "ruled" screen kind, or of that of the "irregular grained" ones, as in the Metzograph grain image, will also both give the same "double-tone" effect, if treated in the precise manner as described for line work.

We may here remind our young readers that the effect of producing this "double-tone" or "halo" upon a half-tone print is to not only enhance the beauty of the image, but to *disguise* the mechanical character and effect of the screen pattern of the picture as well. The great advantage of this particular method is that it is permanent: we have examples of this work done over five years ago which are as perfect to-day as they were at the time of actual printing.

The drawback of the next or single method we are now proceeding to describe is that the "double-tone" tint effect produced by it is "fugitive," and consequently becomes lost eventually—so that for work required to endure for long periods this method does not commend itself, as does the preceding one.

In this particular method only one printing is employed, the "double-tone" effect being produced automatically by the peculiar nature of the colour itself, which is composed of two distinctly different natures;

one, the basic colouring matter bound up to reject or eject the " aniline " staining matter applied to it.

The outcome of this is that the basic colour furnishes the actual image in printing, and then the additional aniline matter that was added to it, but which was not absorbed as an integral part of it, now slowly diffuses out, producing the " double-tone " effect all over the printed image.

The best paper to employ for this type of double-tone work is that generally spoken of as " coated art paper," usually employed by letterpress printers for half-tone printing.

It is ordinary machine-made wood pulp paper, coated on both sides with " Blanc Fixe," which contains a very small quantity of " sizing " matter to bind it. This gelatinous material is never added in any great proportions, so that the coating is rarely very firmly attached to the paper base; and is to a large extent soluble in water: a factor which the litho. printer soon becomes cognisant of, if he has not kept his damping conditions well under control.

The procedure for this then is: first, compound up the basic mineral colour—which, we will assume, is a dark brown, like " burnt umber "; this has to be specially reduced, and mixed up with the lithographic varnish, " Canada Balsam," and a very small quantity of silicate of soda.

When this is done, the colouring matter which has to supply the " tinting," or " double-tone " effect, is then mixed into it. This colouring matter is "aniline," and is ground up in vaseline and glycerine, and some methylated spirits.

More care than usual has to be exercised to prevent tinting during printing operations.

It helps the printing considerably when printing this particular work from zinc plates if a careful preliminary etch up into slight relief is given the work upon the plate.

At first moment of impression, the image shows no double-tone result. This feature slowly diffuses out

more and more, until the maximum halo is attained. This occurs spontaneously in slow progression for a few hours after printing.

We might here also casually refer to still another method by which this "double-tone" effect may be formulated. The half-tone design is first printed in a deep brown, and then the same "forme" is printed in an orange colour just slightly out of register; just so as to partly overlap the first printing, as though it were "half on" and "half off."

This results in showing a tinge of bright colour protruding from the dark colour, just at one side of the work only, which gives a novel character to the print. It is, however, very rarely practised at the present time, as it is not well known to the younger generation of lithographers.

Photo by J. Goodman

"On the Zuyder Zee.

CHAPTER XIII.

"ALUMINIUM."

COMPARATIVE PROPERTIES OF THE TWO METALS ALUMINIUM AND ZINC—GRAINING METHODS OF ALUMINIUM PLATES—BEST MATERIALS AND APPLIANCES—REMEDY FOR "BLISTER" DEFECTS—AQUATINT WORK FROM ALUMINIUM.

WE now pass from zinc to the practical treatment of the "aluminium" plate, as used in metalithographic printing.

Due to the chemical fact that both of these lithographic printing surfaces are *simple metallic elements*, they are thus incapable of being split up, or resolved into anything essentially different from the original substances, zinc and aluminium. When, however, brought into chemical contact with certain other elements or bodies having an affinity for them they can then be made to combine to form compound bodies. These metals, however, behave somewhat differently to each other when similarly treated in the lithographic manipulations.

For instance, the one is most readily capable of taking up a suitable grain by immersion in a weak bath of nitric acid solution; which applied in the case of the other metal yields no graining capacity at all. In fact, aluminium depends entirely upon mechanical treatment for the production of a grain of commercial value in lithographic printing.

In the matter of *oxidation*, the one metal is more pronouncedly susceptible to this defect than is the other.

Again, in the "affinity" values of the fatty and gummy compounds respectively as made upon these

two metals, there is a certain degree of difference between them, which is catered for in the practical manipulations where the most efficient effects are sought for.

It will be our present mission to point out those differentiations which enable the lithographic printer to more effectively equalise the printing results obtainable from these dissimilar metals.

In order to more thoroughly comprehend the basic chemical, and physical properties of these two metal-lithographic printing surfaces, we may point out that the specific gravity of aluminium is roughly about one-third that of zinc. The specific gravity of aluminium being 2.6, while that of zinc is 6.9.

In the atomic weight there is a similar disparity of standard. The atomic weight of aluminium is 27.0, while that of zinc is 64.9.

It possesses comparatively good porosity properties.

Decidedly other physical differences occur in these two metals, notably that of the colour, weight, and the crystalline characters. In the matter of colour, aluminium is by far the whitest, being a tin white metal, which is one definite advantage in its favour, zinc being of a bluish-grey appearance. Aluminium is also more brittle at a normal ordinary temperature. Zinc easily dissolves in a number of weak acids, while aluminium is only slowly affected. Certain alkalies attack aluminium most readily, whilst zinc is much more tardily affected by them.

With regard to the oxidation of these two metals, in the case of zinc there is only one oxide compound known, that of Zn O, in which one atom of oxygen combines with one atom of zinc to form the molecule.

There is also only one compound of oxygen with the metal aluminium, but its proportion is different to that of zinc. The equation of the aluminium oxide is $Al^2 O^3$, so that three atoms of oxygen combine with two of aluminium to form the molecule of that compound.

There is again a difference in the receptivity of these

two metals. In transferring, aluminium does not afford as ready an asylum for large areas of solid work as what the metal zinc does, unless the aluminium plate surface receives a special treatment to render it temporarily susceptible to overcome this shortcoming.

There are various other points of difference, which we shall have occasion to refer to in their due order, as we progress with the details of treatment, that are most effective and suitable to each case.

The first patent for printing lithographically from aluminium was taken out in America in September, 1891.

New aluminium plates can be purchased ready grained for instant use in any texture of grain to suit all classes of work, from "fine photo-litho" to "coarse poster"; and in all sizes, for either hand press, or power machine work; or may be procured plain and ungrained from the makers, Algraphy Ltd., or the other plate supply houses, as see pages of advertisement section.

We commence, therefore, with a new ungrained aluminium plate, one that still possesses the glossy surface of the heavily rolled virgin metal upon it, *i.e.*, the hard "skin" produced by the rolling mill still unbroken, therefore being a new plate as yet unprepared for transferring upon.

We first proceed to remove the grease and this skin, and also to give a preliminary bite on the metal surface. The caustic alkalies are the best agents for this purpose. We therefore make up a strong solution of caustic potash (water $1\frac{1}{2}$ gallons, caustic potash 1 lb.), which is applied to the plate surface by means of a piece of "saddler's felting." The plate grainer should be provided with a strong pair of indiarubber gloves, which can be obtained from the supply houses above referred to. The outcome of this causticising is that not only is the grease removed, but the plate surface has also become roughened slightly and the hard skin destroyed, as these alkaline bodies have a very active effect upon this metal. Quite a contrast to the inert effect which

nitric acid solution has upon it. When warm they are more active still.

The graining proper of the plate may now be proceeded with, after the residue of the potash has been thoroughly washed off; and it may be here pointed out that much of the success of the printing depends upon the graining. (Note, the plate edges may be most speedily and satisfactorily bent by means of the bending machine.)

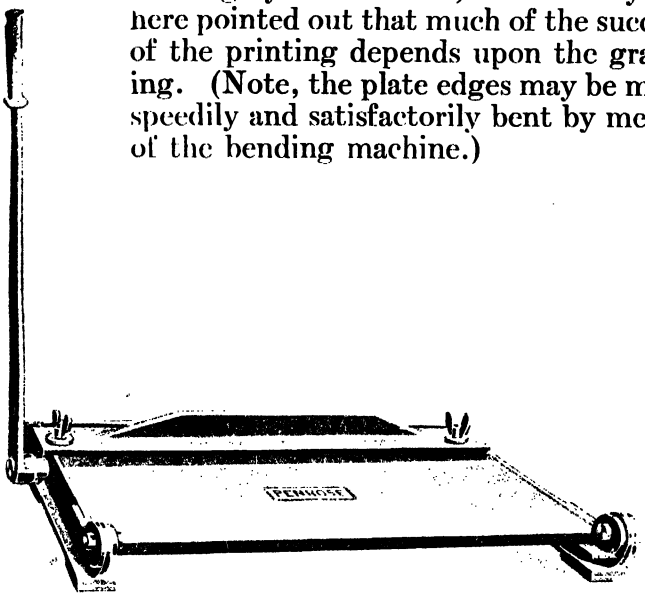


FIG. 28.—BENDING MACHINE.

As with zinc, the best method of graining is by means of the graining machine; although for certain classes of work the Sandblast produces a satisfactory grain. This is, however, for exceptional work, not the general run.

The commonest graining medium used for aluminium plates is pumice powder. Various kinds of sand are also extensively used—sea sand, moulders' sand, and inland sand, as taken from sand-pits in the New Forest district of Hampshire, which are exclusively used in certain districts. Where this latter is employed, a process of drying and pulverising by the aid of flat stones is resorted to, and some really excellent grainings are then produced on these metal plates by this medium. Carborundum powder and Emery powder are also other

abrasive materials that find favour with some users of aluminium plates in lithography.

Various textures of grain are produced according to the requirements of the work, by using coarser or finer qualities of pumice or sand, and larger or smaller marbles, etc. A fine transfer grain would be produced by fine pumice of about 160 mesh texture of sieve, and small porcelain marbles. Even a finer grain still may be used for photo-litho work of the direct method order; whilst for the other extreme of requirements, such as poster work, a coarse grain of about 40 texture is often employed. Glass powder and flint powder is here used with great success, as well as the other agents above mentioned, as larger and heavier marbles.

"Glass" powder is also used in a very wide range of texture, from a coarse grain of 40 to that of an almost impalpable state, in which condition the very finest grain desirable can be produced.

If the graining is done by hand, not very satisfactory results are attained, nor very expeditious ones either: it is only where but very few plates are used that a firm can think of dispensing with the facilities which a graining machine affords. In fact, it is indispensable both from a commercial and an efficient standpoint.

We are careful to emphasise this item, because we have come across quite a number of people who, when commencing to install a metalithographic plant into their establishment, have tried to ignore the importance of this automatic mechanical grainer.

To a firm who only dabbles with a few plates in a kind of half-hearted experimental manner, the cost of a graining machine appears to be a very big item; usually the largest one, where the method is being adapted to the flat-bed machine of the reciprocating type for the first time.

In the British Isles these graining machines can be bought suitable for the largest size of plates for £40, the first cost of which soon repays itself in time alone, to say nothing of efficiency. Moreover, one graining machine will be sufficient to keep 8 or 9 litho. machines

going quite easily under normal conditions. Where the extended method of box arrangement is adopted, in which the grainer box is made adaptable to take at least three tiers of various-sized graining boxes within it, so that as many as a dozen smaller-sized plates may be grained simultaneously, as shown in connection with zinc; then a large number of both rotary and flat-bed machines can be kept going by a single grainer.

As with zinc, so with aluminium; either porcelain, glass, or wooden marbles of both large and small circumference may be employed with the graining powders. River pebbles have also been utilised by some lithographers, mixed up with the graining marbles.

Metal marbles, and the heavier kind of marbles, are not serviceable for general work, although they may be used for special work of an occasional nature. Again, gutta-percha balls of a solid nature, with or without an abrasive powder cast or moulded within their bulk, may also be employed for the production of certain types of grain or roughening on aluminium plates.

The actual graining operations are carried out by sifting some pumice powder over the plate fixed in the graining machine, and then covering it with a layer of marbles, moistening the whole with clean water applied from a fine rose watering-can. The grainer is then set in motion. A new plate should take about an hour with occasional fresh supplies of pumice and water.

Another method not generally known, in which a speedy grain can be effected upon a small aluminium plate—for the production of such work as "*aqua-tint lithography*"—is attained through the agency of a piece of cabinet paper (glass paper), as used by joiners, etc. This is impressed into the plate in repeated and varying directions until the inversion of grain or roughening is attained agreeable to this range of production.

The chief differences in the graining of aluminium plates as compared with zinc ones are that the apexes of the grains produced on the aluminium plate present slightly more crisp and keener mounds than what

would be produced upon a zinc plate, were the same time and conditions of graining followed out on both metals for comparative purposes.

It may be remarked here in passing that this feature is slightly more exaggerated than real, due to the different reflective properties, and the respective lighter and darker hues of these two metals when compared with each other. So that some consideration and allowance must be made when assessing the actual comparative values of the granularity of printing surface of these two metals, by taking this feature into consideration. A final supplementary finish with dry pumice upon the dry plate for two or three minutes by hand-pad working in a circular manner frequently improves the grain.

There is another characteristic in connection with the surface of a new aluminium plate which is almost *non est* with respect to a zinc plate, and that is the rather peculiar feature of surface " shelling " in tiny patches, or " blister " markings. This seems to arise from the rolling, in which some tiny part of the metal becomes, as it were, flattened into the surface during the rolling and pressing operations, and then subsequently becomes loosened on the surface, and finally peels right off, leaving a kind of scar underneath. This usually shows up during the graining operations; there is no remedy for this is in the lithographic workshop except *prolonged graining*. This trouble used to be much more pronounced some few years back than it is to-day; still, it does occasionally occur now, and the young metal plate printer must make himself conversant with the causes and conditions which regulate it, in order that he may the better cope with it as it arises.

The metal-rolling mills used to say that it was unavoidable, but we have noticed a most decided improvement during recent years, which shows that they have improved their methods of production somewhat, and thus minimised this trouble.

CHAPTER XIV.

AFFINITISING OF ALUMINIUM PLATE—REMOVAL OF OLD WORK, AND REGRAINING—GENERAL TRANSFERRING AND SODA TREATMENT FOR TRANSFERRING—MANIPULATING VARIOUS KINDS OF TRANSFER PAPERS—OXIDATION CORRECTIVES—TREATMENT OF TRANSFER INK—FAN DRYING OF PLATES.

AFTER the aluminium plates have been suitably grained, they are washed thoroughly clean, both back and front, and should then be affinitised—that is, rendered as susceptible as possible to take the transfer ink, or litho writing ink, or litho crayon.

This may be done in a number of ways: by means of the alum acid bath as in zincography, with the exception that this bath is made stronger (double strength) to what is employed for zinc.

This bath also purifies the surface of the metal by decomposing any "ooze" or foreign matter that may be adhering to any part of its surface. A simpler form of alum bath without the acid may also be used instead of the above, by dissolving some sulphate of alumina —$Al_2 (SO_4)_3 + 18H_2O$—in water and giving the aluminium plate a good washing with this.

Of course it is possible to dispense entirely with these after-baths, by discarding any affinitising operations altogether. This is, in fact, done by a few firms here in England in connection with the re-use of old machine plates.

An aluminium plate is taken straight from the rotary or flat-bed machine, the ink image being washed from off its surface by means of a small quantity of turpentine applied with a clean rag; it is then affixed in the bed of the graining machine, the marbles, pumice powder, and water applied, the whole set in motion for about three-quarters of an hour, renewing the pumice powder

and water at frequent intervals, when the plate receives no further treatment, other than that of being well washed when taken from the graining box, when it is dried and is ready for the transfer department, or the artist room. We do not, however, consider this method so good as the one where the plate is treated with a supplementary bath as before recommended.

Again it is advisable to thoroughly destroy the greasy image lying upon the plate before it is put into the graining box at all. So that the best course to pursue in connection with an old plate and job just taken out of the printing machine is to use a strong solution of caustic potash, applied with a pad of felting; two or three minutes' rubbing will suffice to decompose every vestige of the "fatty salts" formed with the aluminium plates; and thus there ceases to be any ink work left upon it. All that is then required is to give the plate the requisite surface graining, to enable it to retain the moisture necessary for printing to be accomplished from it, and to give it the tooth necessary to afford a foothold for the rollers when traversing over it in the inking-up operation. Then affinitise and dry.

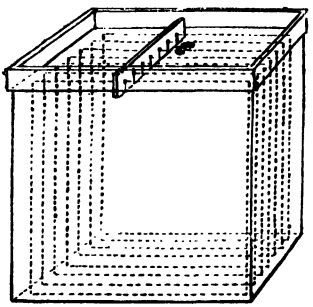


FIG. 29.—UPRIGHT PLATE BATH.

Still another method is to wash off the ink, then place plate in acid bath consisting of nitric acid one part, water three parts; time, about eight hours. (See **Fig. 29.**)

It may sometimes happen that a job has laid upon a

plate for a long time, probably a number of years, in which the ink has become thoroughly hard upon its surface, and the stain of the job appearing very deeply embedded into the metal. In a case of this nature, the removal of the old job is not so easily accomplished as in the case of a new job recently transferred.

Again, if there should have been any special treatment of the ink during printing, such as the intense compounding of it in order to produce a powerful gloss,

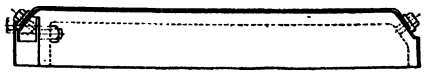


FIG. 30.—SECTION OF IRON PLATE BED.

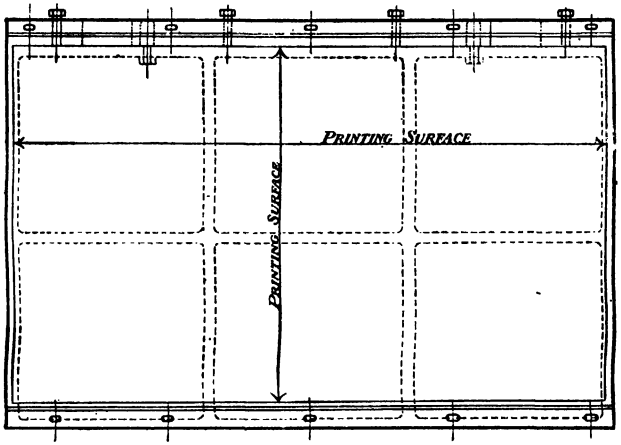


FIG. 30A.—IRON PLATE BED (ALGRAPHY CO.).

or the employment of a plethora of dryers; or perhaps very penetrative oils in it; then the printing image will have become more stubbornly embedded in the metal, and consequently require more drastic treatment to remove all trace of it in a speedy manner, so as to be ready for use again. This can be accomplished by using a mixture of acids: take 4 ozs. of hydrofluoric acid, 4 ozs. of nitric acid, and 4 ozs. of water, and mix well together.

This is then applied with a felt pad or flannel to the whole surface of the metal plate for a few minutes, when every vestige of the old work will have become completely effaced. This fluoric acid should be kept in a rubber bottle, as it decomposes glass. It is also necessary to remark that by itself it possesses a very corrosive action on the skin, the fumes also are irritating to the lungs, so that full care has to be exercised when handling it to safeguard against injury. The graining may then be immediately proceeded with, and no fear entertained of the old work reappearing when transferring down a new job, or during subsequent working, when once it has been removed with this mixture.

After graining, the plate is well washed back and front, and dried; every care being taken by the transferrer that no threads, or pumice grains, pellets, etc., remain adhering to the back of the plate when laid down upon the plate bed in the transfer press. *Run the work down just as to stone.*

In transferring upon aluminium, one or two little peculiarities will manifest themselves, which are not so apparent upon zinc. One is, that solid patches of heavy work do not transfer down upon a damped aluminium plate so readily as they do upon zinc. Fine lines and stipple will appear satisfactorily vigorous and firm, but a patch of solid work will usually show a "yawning greyness" and need touching up. Now there is a remedy by which this difficulty of solidity may be largely overcome, as it is most apparent when thin transparent French transfer paper is used, and consequently the plate here needs damping for the reception of the transfer, before running down. The remedy is to add a very small quantity of common ordinary "washing soda" to the damping water, the proportion being a piece about the size of a small walnut to a quart of water. This has to be well dissolved and diffused throughout the water, and then the clean white cloth that is used for this preliminary damping of the clean plate is saturated with this soda-water and the plate moistened with it; as would be the case with an

ordinary damping before transferring. When the transfer is run down after this special treatment, it will become at once apparent what an immense advantage it has been in securing solidity of the transfer for the heaviest parts. This preliminary plate damping method may also be employed with great advantage in coping with heavy solids when other forms of transfer paper are used, such as plate-to-plate transfer papers, and "original" writing transfer papers; providing that these do not receive as much damping in the damp book as what they would do were this supplementary plate damping not resorted to.

The reason for this is that the transfer paper coating only requires a certain amount of moisture to be absorbed by it when maturing for dampness before transferring. If, therefore, part of this moisture is placed direct upon the plate waiting to receive the moist transfer, then it follows in this case, that the transfer itself must have less moisture in it, in order that there shall not be an excess when the transfer and plate are brought into contact under pressure. It may be remarked that this thin transparent transfer paper is generally employed here in the "British Isles," as well as in a number of Continental countries, for transferring multi-colour register work. In the "States" there is a different method in which a more opaque transfer paper supplants this transparent kind. With the "everdamp" transfer paper there is not the same latitude of this supplementary damping of the plate, unless the paper shall have been subjected to a very dry atmosphere for a considerable time before use, so that in this latter relation the "soda" treatment is not capable of use as in the preceding examples and applications. It is some few years now since we first discovered the use of this soda treatment, which we published in an article in "Penrose's Annual," dealing with aluminium plate work in lithography. Since that time we have received quite a shoal of letters from practical lithographers all over the United Kingdom, all bearing testimony to the benefit conferred by their

adopting it in their everyday work of the trade. We hope that it may prove of equal service to our younger fellow-craftsmen, wherever their conditions of work enable them to give it a trial.

Another method that has been found to afford good results in transferring or drawing upon an aluminium plate is to first wash the plate over with a solution composed of water 1 pint, oxalic acid $\frac{1}{4}$ oz.; then rinse with clean water and sponge, and dry, when the plate is ready for use.

There is an old variety of transparent transfer paper, used chiefly for register colour work, which is known as "oak varnish transfer paper," and is used by some firms in preference to all other kinds for both plate and stone. Whenever it is employed for aluminium plate work it is advisable that the transfer ink should be worked a shade firmer and stiffer than what is employed for either the "everdamp" or the "French" variety of transfer papers.

The reason for the arranging of this stiffer condition of the transfer ink in this case is for the purpose of enabling a slightly heavier film of transfer ink being carried upon this paper, than would otherwise be the case, were the ink made thinner; the motive being that this paper coating possesses such a high gloss finish that it is difficult to pull a fully loaded transfer upon it with thin transfer ink without "bunging-up" the fine work, especially such as *stipple*, *cross hatching*, *close medium*, *fine hair line*, etc.

But when the transfer ink is kept more firm and cohesive, then a thicker film or layer of it can be lifted upon this transfer paper, and consequently a much better transfer to the metal obtained by this means.

With respect to this "oak varnish" transfer paper (which, by the way, is made from "best pale elastic oak varnish" diluted with "turps," and a coating of it spread upon thin foreign bank post paper), the great drawback of this paper is that it loses much of its adhesiveness after a few days from the time of making; this shortcoming may be rectified by using a warmed

plate, which facilitates the transfer operation, and causes the most rapid and close adhesion, as contrasted with the conditions of a cold plate treatment.

This device therefore enables the paper to be used in a much older and staler condition than would otherwise be possible.

There is, however, a better supplementary corrective still, which consists of applying a thin coating of gelatine upon the surface of the oak varnish, which imparts adhesiveness for longer periods; nevertheless, the freshly-made paper is the best.

When the running down of the transfer to the plate has been completed, no matter what transfer paper may have been used, then any touching-up that may be found to be necessary has to be first carried out.

Now, in the case of the oak varnish paper it is not necessary to wash the plate over with clean water after the transfer is on, and before the "touching-up" can be effected, as in transferring with this paper no preliminary damping of either the plate or paper is necessary. Here in this instance the coating of the transfer paper is an insoluble one, the only example of this condition amongst the whole range of transfer paper.

Therefore as soon as the oak varnish paper is peeled from off the plate surface, any "touching-up" that may be necessary is at once proceeded with.

In connection, however, with all the other forms of transfer papers, there is a deposit of their soluble coating, always left upon the plate surface when transferring; it is imperative that this shall be removed before any effective "touching-up" or "repair" work can be done upon the plate.

A plentiful washing with a sponge, and some clean, warm water, soon frees the plate of this composition. After rapidly fanning the plate dry, the touching-up is at once proceeded with.

In transferring AUTOGRAPHIC WORK to aluminium plates, it is always advisable to give the plate a wash over with turps, and afterwards to rub the job

up with the black ink rag. This applies to builders' quantities, schedules, auto-circulars, etc.

It is necessary to bear in mind that it should be made a definite rule to always accomplish the drying of the plate in as speedy a manner as possible, whenever a pause in the working has to be made, so as to safeguard against "*oxidation*" troubles.

Water or moisture should not be allowed to stand indefinitely upon the plate, or to dry spontaneously upon it.

This oxidation of the aluminium plate is really the rust of this metal; just as iron rusts, so does aluminium; the free oxygen in the atmosphere in the presence of moisture combines spontaneously with the metal, forming an oxide of it—aluminium oxide.

The oxidation marks are at once distinguishable by the white powdery formation which it produces, and which comprises it.

The outcome of this defect is most disastrous to the work, as every particle of this oxidation will take up ink from the inking rollers, and retain it so tenaciously that it prints just as strongly as what the legitimate work of the job does.

The physical peculiarity of this oxide is that it eats away a superficial layer of the metal so rapidly, leaving behind in those parts an uneven, pitted cavity wherever it has operated this oxide formation.

Whenever oxidation has commenced upon an aluminium plate it should be dealt with at once, so as to rectify it again with the least possible delay, as the injurious effects of it progress with time.

Every trace of this oxide formation must be removed and the pure, plain metal again established in the affected parts.

These defective places will then have to be strenuously re-etched, so as to "desensitise" them to grease, by converting them from the plain metallic state into that of an hygroscopic condition, in which state they will imbibe, and retain moisture perfectly, and thus become proof against degradation of ink markings.

The old method of removing this oxidation was to first scour out the attacked portions with an abrasive material, such as pumice powder, or glass powder, applied by means of a rubber strip or a wood point. When the whole of the affected portions of this oxidation have been frictioned away from the plate by this means, each portion has to be thoroughly etched with the mixed phosphoric, gallic, or chromic, and gum etcher, so as to render those portions immune to greasy ink.

A final rapid etch with the same etcher, all over the plate, completes the procedure of this operation.

Another method for correcting the corrosion of an aluminium plate is to scour out the affected parts with a 3 per cent. solution of ammonia bichromate and some fine pumice powder applied with a sponge, then clean the plate with water, gum-up, roll-up, etch, and gum.

It may on some occasions be found necessary to repeat the whole process before every trace of this oxidation is eliminated, and perfectly satisfactory results are assured.

We shall refer to a later method in the next chapter.

As this feature of metal plate printing is so insidious a drawback of the process, it will no doubt be both helpful and beneficial to those who are just building up, or anxiously acquiring, experience in the process—as well as to many old workers in it—to have pointed out to them some of the more obscure and hidden causes of this trouble, as well as some of the directions in which the action is first generated, yet which frequently escapes detection by the busy worker, whose attention is more inclined to be centred upon the next oncoming phases of the process, rather than in the contemplation of those that have already transpired.

Hence it is, that some of these causes are passed over undetected, and unnoted, the trouble having been engendered in these preceding stages of the work.

In this connection we may here be pardoned for remarking that an essential piece of apparatus, which should form part of the practical tool equipment of

every metal plate worker, is a "hand fan," in the form of a flag whirler, made of a shalloon carton board. This is the simplest and best device that can be conveniently employed, and one which is now in universal operation. An electric fan may be utilised where conditions are favourable.

FIG. 31.—HAND FAN FOR DRYING PLATES.

It is rather an unfortunate coincidence that in the past there should have been so few members of the craft who have acquired a useful knowledge of the science of chemistry, as this would be of so material an advantage and assistance to them in their everyday work at the trade.

Even though they only acquired a working knowledge of "elementary inorganic chemistry"—without studying the advanced stages, or organic phases of this adjunct of our trade—this basic knowledge would afford them a clearer insight into the underlying principles of their industry, and enable them to lay the finger of redress upon causes which are not readily comprehensible or intelligently explainable otherwise.

Not only would it do this, but what is of far more potent importance, it would enable them to steer clear of many pitfalls, and vicious troubles, which the lack of this knowledge renders them prey to.

CHAPTER XV.

INFLUENCE OF CHEMICAL ASPECTS OF THE CRAFT—GUMMING-UP METHODS—DOCTORING AND REPAIR METHODS—CLEANING-UP AND TOUCHING-UP PROCEDURES—COUNTER-ETCHING OR PREPARATION OF ALUMINIUM PLATE FOR ALTERATIONS—SCOURING-OUT METHODS—ANECDOTE.

We will here respectfully submit a single concrete example as to where this technical insight would be of great advantage to the litho-craftsman in saving him trouble in his everyday work, by instancing the "transferring" operations; selecting that stage of them where the transferrer has completed the "running-down" of the job upon the metal plate, wherein he may have used transfer papers requiring or possessing moisture, such as either the "French," "Columbia," "Berlin," "Copper-plate," or the "Everdamp" varieties of transfer papers; and assuming that there has not to be the usual "touching-up" done upon the plate; his next procedure has of necessity to be the task of washing away from the plate the soluble coating composition deposited there from the transfer paper coating, otherwise the touching-up ink would have no real effect upon the plate, as it would not hold.

In carrying this out, the transferrer has to use a plentiful supply of water to dissolve away this composition; this, of course, results in the leaving of a film of moisture upon the surface of the plate. If, as is frequently the case, he should now proceed to "gum-up" the plate on top of this film of moisture, without having previously fanned it dry, then it is right here that he commits an act which is so frequently the sole and prime cause of this oxidation trouble, if the plate

should at this stage have to stand aside for a while as leaving-off time at night, or during dinner hour.

This occurrence is so simple and innocent in procedure that the uninitiated would hardly conceive of its being responsible for the great aftermath of trouble which it is so often the precursor of.

The chemical moral, therefore, to be deduced from this incident is to avoid stagnant damp, as this indicates that a very small quantity of moisture in conjunction with air can, upon being imprisoned together, under a dried coating of gum arabic solution, produce this injurious and troublesome defect known as "oxidation."

As a wise precaution, the careful, skilful, and intelligent workman will see to it that moisture shall be removed before the gumming-up operation is proceeded with at all.

There can be no doubt about it that the chemical aspects of this source of oxidation have hitherto escaped the attention of a tremendous number of working lithographers; we have ourselves had frequent occasion to draw attention to it, and to point out the importance of it to hundreds of our fellow-craftsmen in all parts of the British Isles where we have been privileged to give practical instruction and tuition in metalithography.

It is no surprise to mention that the vast bulk of transferrers have frankly admitted that this possible channel of trouble had hitherto been unrevealed to them and unsuspected.

Another simple cause of this oxidation defect is traceable to the use of unconditioned super-moist-"everdamp" transfer paper—*i.e.*, when this class of transfer paper has been unduly exposed to the atmosphere during a wet season, or has taken up more than a due proportion of moisture into its composition.

The outcome of this is that the paper adheres so tenaciously to the original plate from which the transfers are being pulled that it is impossible to remove it without tearing the paper; the delay thus occasioned, and the subsequent soaking off of the adhering transfer

paper with water, causes the plate to be subjected to an undue prolongation of stagnant moisture, which invariably results in a general oxidation of the whole surface of the plate. It is therefore advisable to bear in mind the risks attending the use of a *too damp transfer paper*, and during damp weather to have this paper well protected against these atmospheric changes: or, otherwise, where it has become too moist, it should be subjected to a drier atmosphere until the excess of moisture has been driven off.

We have already given the older method of removing this oxidation; the new one pursues similar lines of procedure, except that the etcher substituted in this latter method is a non-corrosive one; yet it forms a much more powerful and effective chemical combination with the aluminium plate from a "hygroscopic" basis than any preceding etcher has ever done.

We here allude to the "ammonium salts" etcher (a similar kindred production to the one which we gave the formula of in our "zinc plate" section of this book)—the Dr. Streeker etcher for aluminium.

Those who have followed our previous chapters will be familiar with the details of the composition of these non-corrosive etchers, so that we need only here refer to the manner in which the etcher is actually used for the removal of this oxidation defect.

This etching powder is dissolved in water, in the proportion of one gallon of water to five ounces of the powder. A small quantity of this solution is poured into a saucer, and is then slightly coloured by adding a small quantity of fine "rouge" powder to it, and well stirring it in.

This coloration of the etcher enables the transferrer to see precisely where he applies it, and safeguards its flow upon any of the perfect portions of the transfer.

It is then applied to the oxide affected portions of the plate; using for this purpose either a hard wood pencil, a rubber strip, glass brush, or quill. For larger masses, a piece of felting is employed, dipped in the etcher. It will usually be found advisable to use in

conjunction with this a small amount of pumice powder on the first time of applying, and to then go over again finally with the coloured etcher alone.

This course of going over the affected parts twice should be rigidly followed out, so as to make fully sure that no trace of the oxide remains after the treatment. A final "all-over" etch, consisting of three minutes' duration, should always be given, so as to secure a uniformly etched surface, as it will be remembered that it takes that period of time to enable this etcher to set up the galvanic action with the metal, which forms the great feature of it. The resultant "hygroscopic" compound thus formed with all the bare exposed portions of the plate, produces the perfect "desensitised" surface which is so valuable a factor in high-grade metalithographic printing.

The residue of the etcher is finally washed off with clean water and the plate dried, then gummed up and again dried, when it is ready for working from again just as before it became oxidised.

We can now return and resume again the transferring operations proper upon aluminium plates, where there is no oxidation troubles in evidence, and resuming at the "touching-up" part of the operations. Our next task here will be to gum the plate up thoroughly with a moderate coating, which is at once fanned dry.

This is done for the purpose of enabling the gum to get a first grip of the plate everywhere upon the bare metal, *i.e.*, the inkless portions of its surface. Sour gum must be strictly avoided.

As this preliminary coating is thicker than is advisable, or convenient for washing-out purposes, the custom is to pass a damp water sponge over the gum coating, or else to squeeze a small pool of water upon the plate, and then by means of a clean gum cloth thin this coating down to a fine, even film; or the thick gum film may be washed off and the plate dried, then gummed up, this time with a thin film of gum. This is then fanned thoroughly dry.

(Some transferrers pour a few drops of bichromate

solution upon the moist gum, and rub it in with the gum cloth.)

In the above thin film condition the job can be easily and speedily washed out, whereas if otherwise the thicker film had been retained, there would have been the greatest difficulty experienced in getting the ink of the image dissolved from off the plate, on account of the gum layer resisting the washing-out fluid.

The work is now washed out over the dry gum by means of the usual asphaltum tincture, leaving only a thin layer of this wash-out fluid upon the plate. This also is fanned dry, so that all the volatile spirits in it shall have been dissipated, and then, in the case of these aluminium plates, it is by far the best method to rub up the work (here at this stage) by using a small quantity of thin black ink, applied by means of a piece of soft, clean rag.

The rubbing-up is carried out in the usual manner, of using the gum sponge in one hand and the rubbing-up rag in the other.

We may here appropriately refer to an excellent wrinkle for bringing up the work should it be at all refractory in coming up firm and strong. Take a small quantity of metal polish, the one known here as the "Globe" metal polish, and sold in penny tins for the purpose of cleaning and polishing brass and other metal utensils; this is the finest paste that can be added to the ink that is used for these "doctoring" rubbing-up purposes. When all other means have failed for bringing up the work of a transferred design which had lost much of the vitality of its greasy character, we have been able to bring back life and vigour to it by the simple addition of this common article.

Although the liquid "Terebene" is an excellent substance to use as a rubbing-up agent where the work is weak or has become injured, this metal polish wrinkle is infinitely better, as it will invariably succeed where the other has not proved successful.

When all the work has taken up a sound film of fresh ink from this rag, the plate should then be gummed up

again before proceeding with the next part of the transfer operations.

In this respect we have the choice of two methods: (1) We may proceed to roll up the work on top of the rubbing-up, without the "washing out" of the job again with the greasy asphaltum fluid; or (2) we may wash out again a second time with the asphaltum tincture, immediately after the rubbing-up procedure.

We prefer this latter course. Therefore after this second washing out we roll up the job with black ink, and a good nap roller; when, after this course of treatment, every part of the job should respond satisfactorily to the rolling up, in which the solids shall appear firm and the fine work sharp and solid.

Should an individual line, or a stipple dot, not appear to be quite as strong as it should, this may be put right and repaired by going over it with a sharp-pointed 6H hard lead pencil, and then dabbing on a small quantity of black ink over the repaired part with the finger.

For simple transfer repairs of this kind, this graphite touching-up method is quite effective. When weak work is repaired in this manner, it should take up the printing ink again from the roller, and be quite equal to the adjoining perfect parts of the work.

At this stage, the cleaning-up of the dirt of the transfer is usually done, using an "indiarubber strip" dipped into the etcher along with a small quantity of pumice powder, so as to maintain the rough grain of the plate as much as possible. For smaller spaces of the work, a "quill" is used, also dipped in the etcher. Some workmen prefer to use "caustic potash" or "caustic soda" in place of the acid etchers for cleaning up.

Both "soft" and "hard wood points," as well as "charcoal strips," are used for cleaning-up purposes also upon aluminium.

Where larger areas of the work have to be cleaned up, then a piece of flannel or felting is employed, also dipped in the etcher, and the pumice powder.

Where the work conveniently admits of it, the bare finger may often be satisfactorily used for removing dirt from the plate.

Where only a light scum should have gathered over part of the work, due often to too thin an ink having been used in the rolling-up part of the work, this surface scum may be removed by dipping a clean, fresh piece of soft flannel in some clean water, or in an exceedingly weak solution of gum arabic water, and then applying this to the scummed parts.

If, through any unforeseen cause, there should be any portion of the work, such as closely chalked or stippled portion, develop into a "bunged-up" condition, then this thickening may be removed by simply rubbing the clean piece of flannel upon a piece of soft cuttlefish bone, so that the flannel shall take up a layer of this chalky material, which, when applied to the thickened portion, will scour out these heavy parts and restore them to what they originally were before the thickening defect had occurred.

If the first application of this does not effectually remove all traces of this defect, then a second application of it must be applied, when the proper character of the work will be restored again.

Simple as this remedy is, some workmen cherish it as a great trade secret, guarding it with the utmost secretiveness.

A most glaring example of this "mystery faking" procedure was observed by me some few years ago in a lithographic establishment of which I was foreman. I had occasion to hustle through a special job that was most urgently needed, when, in order to get it through with the utmost expedition, I had put two transferrers to work upon it at the same time, so that one man could make progress with one end of the plate whilst the other was proceeding with the other. Due probably to the extra speeding-up which was being applied, one of these transferrers had got some part of the shadow portion of the design bunged up. Whilst keeping a casual "look-out" upon the progress of this

job, I had noticed this transferrer keep running in a most suspicious manner to the back of the press; this aroused my suspicion that something "fishy" was taking place, so I made it my business to go up to this man and inquire of him the cause of his sprinting around the press in this peculiar fashion!

His reply was: "I am scouring out the shadow part that has got thickened, and don't want to let Darlow see me use the cuttlefish, or else he will know how to do it in the future, as well as what I do myself."

This kind of selfish spirit was much more pronounced in the earlier days of metal plate printing than what it is now, thanks to the broadening influence which trade journalism and technical tuition have disseminated.

It is to be found still amongst the few who ignore the value of these mediums of knowledge, by refraining to study their trade literature and the technically practical side of their craft.

In addition to the "cuttlefish" method, impalpable glass powder, or very fine pumice powder, may be used for the same purpose.

There is still another method by which this "closing-up" of the "middle" and "three-quarter tones" may be rectified by skilful manipulation.

This method, which we are now about to describe, is somewhat more difficult to explain verbally, inasmuch as it implies a discriminating manipulation, rather than an absolutely exclusive treatment.

It consists of so manipulating a piece of flat india-rubber that it will only barely touch the metal surface with just sufficient verve to free it of the scum, without gripping it so firmly as to remove any ink from off the actual ink lines of the job.

To do this effectually, the transferrer has to practise "poising" the rubber very loosely between his fore-finger and thumb, then to draw it so delicately over the face of the plate that it will only bite the scum, leaving the job itself unimpaired. In skilful hands some very remarkable results are obtainable by this method.

As it is not commercially practical to reproduce a

" matte " grain upon a small portion of the aluminium plate, where it may have been flattened down in the cleaning-up operations, it is doubly essential that the transferrers shall avoid the taking away of the grain when cleaning up upon an aluminium plate. This metal, unlike zinc, is not amenable to simple acid treatment in re-roughening it again, after the " matte " grain has been prematurely removed.

We may therefore call the attention of those of our readers who have not experienced machine work with this metal, that there is an excellent way in which they may avoid this trouble when working upon small portions for removing dirt from them, by resorting to the glass brush, as described in the zinc section.

This glass brush will then enable the cleaning-up to be done without the burnishing or polishing away of the grain, as is the case when a wood point is used.

Some transferrers use a 12 per cent. solution of sulphuric acid for cleaning up a dirty plate; but it must be borne in mind that this acts as a kind of sensitiser, as well as bleaching the plate whiter in the parts where applied. Therefore, unless measures are taken to safeguard these cleaned portions against grease, they will soon become soiled again as badly as ever. The aluminium plate etcher, and gum, desensitise them to grease.

For preparing any portion that needs " touching-up " or " additions," the best medium to use is the " counter " etch, which consists of a 4 per cent. oxalic acid solution. This is usually prepared in the following manner: A saturated solution of this acid is prepared, by dissolving it in water, taking care that there shall be more of the acid crystals than what the water can dissolve or imbibe; then this saturated solution is kept as a stock solution, so that when any of this counter etch is required the transferrer takes 4 parts of this stock solution and adds to it 96 parts of water. This, after being well shaken, may be at once used for the purpose of preparing the plate for additions, just as alum water or citric acid solution is used upon stone for a similar purpose.

This oxalic acid solution after being well applied to the plate, in the parts where the corrections or additions have to be made, is then blotted off by pressing a piece of clean blotting-paper upon the parts treated with this counter etch. These places are then finally well washed with clean water applied with a clean sponge, that should always be kept for this purpose alone. After thoroughly well drying the moisture out of the plate, it is then ready for the additions to be put in, either new drawings by hand, or transfers, run down by the press, the unalterable portions of the work being protected by "gumming out."

CHAPTER XVI.

PRINCIPLES OF PLATE TREATMENT FOR ALTERATIONS AND CORRECTIONS—STRECKER PATENT ETCH FOR ALUMINIUM PLATES—FORMULA FOR UNIVERSAL ALUMINIUM PLATE ETCHER—STORAGE OF ALUMINIUM PLATES—ACTION OF ALKALIES AND ACIDS UPON THE METAL.

THESE resensitising operations are frequently fraught with failure, due to inefficient application. It may be of advantage to here point out the precise technical conditions sought to be attained in the perfect accomplishment of this repreparing procedure.

In the first place, those portions of the plate where the alterations had to be made were composed of a "gummate" of the metal; instead of their consisting of the pure metal aluminium alone. This "gummate" had been produced through the action of the "gumming up" of the plate with the gum arabic solution; in which this gum liquor, with the addition of the free oxygen of the atmosphere, had combined chemically with the surface metal of the plate, and thus formed a "compound" there, instead of the simple metallic element that existed, prior to the application of this gum solution.

Now the object of applying this oxalic acid solution is to decompose this gum compound, and thus to restore the surface of the plate in those parts back again to the virgin metallic state; in which condition it is capable of retaining the fatty acids of the greasy inks which form the work of the image. Thus, if this operation is properly done, then we have again obtained there nothing but the *plain bare metal*, free from admixture with any deleterious matter, which is injurious or antagonistic to the fatty matter which we must ally chemically with this pure metal of the plate; but which

we cannot do if an anti-greasy compound already exists there, such as the " gum compound."

This "gum compound" being a most vigorous grease resister, has necessarily to be completely removed from the plate before the " grease compound " can hold; as the metal is incapable of retaining them *both* at the same time, upon the same identical area.

If, then, there is not sufficient oxalic acid solution present to react upon the whole of this gum, then some of the gum remains in the plate surface, and acts as an antidote to the greasy ink, and thus neutralises its action upon the plate; the consequence of which is, that there is no job formed there after the ink is applied.

To ensure then that this re-preparation of the plate shall be truly done with certainty, it is advisable to always give a second application, after having blotted the first one carefully off.

As this only involves two or three minutes' outlay of time, and the cost of the material is infinitesimal, it should be made a rigorous practice of carrying it out always.

This *resensitising* can also be done by the aid of other chemicals, but it must be borne in mind that the surrounding work of the job has to be rendered safe from injury during the treatment, otherwise it would often be a quicker method to retransfer the whole job again, rather than to have to repair an inordinate amount of injured work; that is why this oxalic solution is recommended as the premier one for this purpose; as there is not the same risk involved in its use as what there is when more rapid and corrosive chemicals are employed.

The removal of " defective " and " incorrect " parts may also be done with sulphuric or hydrochloric acid solutions applied to the plate for about three or four minutes, then blotted and washed off with clean water, and fanned dry. Resensitising may also be done with the following solution: Water 1 gallon, alum powder 2 lbs., hydrofluoric acid 5 ozs., alcohol 9 ozs.

Where the requirements of the work only need the

elimination of a portion of the design, without the need of having to put fresh work there in place of the portions removed, such as the taking away of a superfluous line, or dot, then there is no need to resensitise these portions of the plate; this dirt is most speedily and effectually removed by means of a strong solution of "American rock potash," costing 6d. per lb., which has a most powerful effect in destroying grease from the plate, and without having to scrub the surface unduly hard as to flatten and injure the grain.

If the "glass brush" is employed in conjunction with this, then there is no risk of injuring the grain of the plate, unless unnecessary scrubbing is resorted to.

The advantage of this American potash over that of the purified caustic potash and caustic soda is that it assumes a red coloration automatically, through exposure to the atmosphere, which serves the useful purpose of showing where it is applied, so that it is easy to prevent encroachment upon the good portions of the work upon the plate.

Beyond this again, it is more rapid and searching in its vitality, and thus accomplishes its purposes more quickly than the more refined qualities of the bleached potashes do; whilst from a monetary point of view it is much less expensive, bulk for bulk.

Another method of removing old work, and to preserve the grain of the plate, is to wash off the ink with benzole, then etch with solution of cyanide; absorb residue off with clean blotting-paper, etch with phosphoric, then resensitise, or counter-etch twice with oxalic; blot off, then wash with clean water. Then transfer or draw in the new work; finish as above.

When all the new work has been put in, and the "cleaning-up" and "sharpening-up" of the work of the transfer has been skilfully carried out, by one or other of the various methods we have already given a detailed description of, then the plate should be French chalked and gummed up, so as to prevent any scum of the removed work being revived when the

roller passes over it again, before the final, thorough etch is given.

The gum is washed off, and the work is now again rolled-up with the nap roller, and good black ink, upon the top of the French chalk previously applied. When the work has received this additional charging of ink, it is again resined, and French chalked, and is then ready for the etch.

This etch must be thorough, and as we have already given it the protection of two dustings-in of resin, etc., we have no fear of the etch getting through the work, provided we do not scrub the etcher over the work in a rough and careless manner.

If we apply the ammonium etch, we shall have to give it three minutes' application to effect the full force of its potency.

On the other hand, if we use the phosphoric etcher, then we shall have to be guided by the character of the work, as to the limit of time that we bestow upon the plate for the etching operation; as well as the strength or proportion of the phosphoric acid to the gum used as diluent: approximately about one-third of the time is usually allowed.

Further modifications of time must be arranged should the etcher be made up of a multiplicity of acids, or etching mediums, as when gallic acid, phosphoric acid, hydrochloric acid, gum, etc., are all comprised in the same formula for etching aluminium plates.

This composition of the etching medium has a bearing upon the subsequent moisture-bearing properties of the plate when undergoing printing operations in the power press. Some etching solutions yield a more soluble compound with the plate than what others do. The outcome of this is, that their protective properties which they have afforded the plate for printing conditions are more or less durable, according to their capacity of solubility or insolubility. If an etcher is used, which is soon dissolved off with water and friction during the running of the machine, then the machine-man is perforce bound to resort to adding compensating

etching substances into his damping water; or otherwise he "doctors" his ink; as once the protective influence afforded by the original etcher has been exhausted from off the plate, or rendered inert; then, unless he stops his machine to apply another etch to his plate of the same character and efficacy as the first one, or a better one, then the only other course open to him is the channel just indicated; otherwise the plate cannot resist degradation in its plain portions, as when they have lost their etched formation they become so sensitive to greasy ink.

Supplementary daily etchings may be given the plate during long runs.

But where the nature of the etcher is such that it produces an insoluble hygroscopic compound with the plate, then it maintains its water-retaining capacity for much longer periods of the actual working state, and thus does not depend upon the supplementary aids being applied to the inks, etc., for damping purposes.

For the benefit of the younger members of our craft, we append the formula of a general etcher for aluminium, one most extensively used by those firms who do not purchase proprietary or patent etchers. It is composed as follows:

Gum Arabic solution (of the consistency of honey)	70 ozs.
Phosphoric Acid of a 20 per cent. strength	10 ozs.

Storage of Aluminium Plates.

Work on aluminium plates may be preserved, and the plates stored away, by washing the job out with the Asphaltum tincture over the dried film of gum.

Another method is to wash the job out, and then to roll-up with preserving ink consisting of spermaceti three parts, mid varnish two parts, white wax one, olive oil three, Burgundy pitch three, black ink three. Or the work may simply be rolled-up with retransfer ink and chalked, then gummed.

Carbolic acid and turps mixed will remove the hard,

stale ink from an old job which has been stored away for a long time.

Work on aluminium plates can be etched into relief with hemi-chloride of copper, and solution of acetic acid; but the rubber offset developments have rendered the necessity of this virtually effete.

Action of Acids and Alkalies upon Aluminium.

Hydrochloric acid dissolves aluminium easily, hydrogen being evolved, and the chloride formed in solution : $2Al+6HCl=2Al Cl_3+3H_2$.

Sulphuric acid dissolves it more slowly, whilst in nitric acid it is dissolved more slowly still.

Alkalies such as caustic soda dissolve aluminium much more readily than what they do zinc, hydrogen being evolved. The following equation explains the chemical reaction : $2Al+6Na\ OH=2Al(ONa)_3+3H_2$.

CHAPTER XVII.

THE "FREY" PHOTO-CHROMO PROCESS—WORKING METHODS—DISCRIMINATING GRAIN—TYPICAL EXAMPLES —LAWS AND PRINCIPLES OF THE THREE-COLOUR PHOTO-MECHANICAL PROCESSES IN METALITHOGRAPHY.

It is no exaggeration to aver that there is now being done, from metal plates, a more superb range of "colour," and "commercial" work in lithography, than has ever hitherto been equalled, much less excelled, during the history and life of the whole craft; and which could never be done so well from the stone, even under the most favoured and concessionary conditions.

As the first example we instance the artistic "Frey Photo-Chromo productions," with their delicate, screenless grain, possessing an adaptive and "discriminating tone grain gradation," ranging between "deep shadow" and "high-light," and which cannot be imitated by "hand stipple," or orthodox ruled screen, photo mechanical methods of to-day.

Some of the latest products of this process may be examined at the art dealers' and print-sellers' stores; such as the "Ostend Fishing Boats," by F. J. Albridge; "The Pool of London," and the companion picture, "Above Greenwich," by Chas. Dixon, both of them being London river scenes of a most interesting character.

Other art plates are those of the "Dutch Flower Girl" and "Bruges," by L. B. Bhurl, and two large panel scenes of "Oriental Life," the "Market at Cairo," and the "Water Seller," which never fail to command admiration and to win prestige, both in public and expert circles. Although only chromo-litho.

prints from zinc plates, they sell readily all over the British Isles from 5s. 6d. each—a measure of value and privilege which no modern *relief* process prints can lay claim to.

It may prove of more than passing interest if we describe the process in brief detail and technique.

Mr. Frey, the inventor of this screenless litho. colour process, is one of the sons of the firm of Messrs. Frey & Sons, the well-known art printers of Zurich. Having served his time as a lithographic artist in his father's establishment, he followed the old custom so prevalent on the Continent of journeying to other cities, in order to acquire knowledge and experience of other classes of work in lithography. This is known as the "Wanderjahr"—the wandering year of the young craftsman in pursuit of skill and prestige in his trade.

As an outcome of this practice, Mr. Frey worked in London. One of the firms that he secured employment with was the large establishment of Mons. Faustin. Here he was set to work as a "stipple" artist upon "chromo art calendars."

It was due to the mechanical monotony of this "perpetual dot work," and the irksome revulsion that it set up in his mind, that the lithographic world owes the introduction and establishment of this new process.

He first asked himself, could not this be better done by photographic means? Then he consulted all and sundry for information as to the possibility of doing this by the "primal aid of the camera." He received so little help and encouragement that he determined to take the "bull by the horns" and attempt the study and practice of the idea by himself, and with what supplementary practice he could get at the technical schools to aid him.

He returned to the Continent, and studied "photo-mechanical process work" at Charlottenburg, Germany; then again at Zurich. At last, after many wearying experiments and disappointments, he found himself working along the right lines, the final outcome of which was the birth of this new "Photo-Mechanical

Chromo-Litho. Screenless Process," now known as the "*Frey.*"

The method is as follows: Either the original picture, or a *facsimile* water colour sketch, is made of it, then placed upon the copyboard of the camera. Colour selective negatives are made of this through liquid colour filters, a slight variation being made in connection with the orthodox red, green, and violet filters, universally employed.

Collodion Emulsion is the sensitive media used for making the negatives. Sometimes very large plates are made, suitable for making 60 by 40 posters.

Necessarily the camera is a large one, the largest we have ever been brought into contact with: we could walk about in the bellows of it quite comfortably, which may convey some idea of its immense size.

The thick crown negative glass that is used is cleaned in the ordinary manner with "Methylated Iodine solution" and coated with Collodion Emulsion. The plate after exposure is developed, and any retouching carefully done.

Next a zinc plate is sensitised with a sensitive asphalt solution, which is so compounded as to yield the special articulate grain of this process.

The negative is attached to this sensitised plate, and exposed to light. It is rather a slow, "light" printing process.

When the exposure is completed, the image is developed with turps, etc., and is then ready for the finishing touches of the artist.

Next comes the correcting. Those sensitive parts of the image, corresponding to the "lights" of it, are dissolved away, almost automatically. Mr. Frey has adapted a liquid medium whereby he can remove any part of the actual image, without scraping or polishing; just merely painting on with a brush this fluid, which effects the change in a steady, gradual manner, and which can be arrested at any moment.

A special department is devoted to this work. Here may be seen some dozen lithographic artists, carefully

surveying each zinc plate immediately after the development is completed. Their task is to enhance the results and effect wherever possible, by *taking away superfluous work*, or by *adding additional work* where strengthening of parts would improve the contrast, or range of colour values; and also to compensate for the unavoidable shortcomings of the colour renderings of the "tri-colour filters" in camera work.

Another important part they perform is, that as more than three printing colours are always used in the "Frey" process; frequently seven or nine colours being the number employed—for example, two reds and two blues, yellow, one grey and one brown—they have to adapt the work produced by the negatives for the work of these seven colour printing plates.

For instance, the red printing plate is made from the negative that was produced through the green filter, or green sensation screen, as it is variously termed. Now as this negative produces work on the zinc plate that will, when printed, depict all the red hues of the coloured original, that same negative may be utilised to produce the printing plates for both the "dark red" and the "pink" in the Frey nine-colour chromo; just as is the pink work, when the job is drawn by hand, made to fall over the dark red in an "orthodox" chromo-litho. job. So here two separate printings on zinc may be made by means of this red printing plate negative. One of these would be worked up by the litho. artist for the dark red, in which case he removes every particle of work other than that which he requires to represent the darkest red hues. Some parts he may find it necessary to fill in solid in order to intensify the effect.

With the other red plate, as this is to serve for the pink, he may not find it necessary to add anything, and, in fact, to take but very little away. Much will here depend upon the individual judgment and skill of the artist himself, and the effect sought to be produced in the reproduction.

And so on in regard to the blues. Two photo prints

on two different sheets of sensitised zinc are made by means of the colour negative produced through the red primary colour filter. These two prints, after development, are employed for the making of the light blue printing plate of the reproduction, and the dark blue printing plate, respectively.

Likewise is the case with regard to the other primary filter—violet, or ultra blue, as it is variously expressed, from which the yellow printing is made.

Thus instead of representing the original in but the bare three primary colour pigments, as in the tri-colour relief block methods, they are here extended into a wider and more delicate range of colour values, a *dark red and a pink* taking the place of a *single red;* and a *dark blue and a light blue* taking the place of a *single blue printing*, and so on.

By this means a much more soft, delicate, rich, and faithful reproduction is secured, without the obtrusive false tones which accompany the ordinary half-tone tri-colour screen negative print, where the tints have to be represented, by arranging the white surface (on which the three primary pigment colours are printed), to be exposed in varying degrees of colour proportion.

To make this more clear to those who have not hitherto had any opportunity of pursuing the study or practice of these three-colour photo process methods, we may submit the following brief reference as being descriptive of the salient features and outline of the trichromatic process.

When it is desired to reproduce a coloured original, such as, say, an "oil painting" or "water-colour drawing," or "chromo-litho. print," we must first make three negatives from it, through colour filters, upon suitable photographic plates, made sensitive to coloured light.

These colour filters are so synchronised to the photographic plates that the first negative only records the *blue light*, the second the *green light*, and the third the *red light* reflected from the original; the purpose and function of these colour filters being to "absorb"

and " arrest " any light to which the plate happens to be sensitive, other than that required to make the respective colour records, and prevent it reaching the sensitive plate.

In addition, the ruled half-tone screen is used to separate or produce the broken tones.

From such negatives the printing surfaces are made. These printing surfaces are printed with inks, respectively absorbing the lights photographically recorded.

For example, we print with a " yellow ink," the printing surface made by the agency of the negative procured by means of the " *violet*," or " *ultra blue* " colour filter. This corresponds to the first primary pigment.

We next print in a " red ink," the printing image made by means of the " *green* " record negative. This corresponds to the second primary pigment. While the third primary pigment printed is the " blue," the printing image of which was made from the " *red* " record negative.

Thus we have " primary light sensations " as produced when white light is broken up into three constituent rays of red, green and violet, as when passed through a prism; all colours we perceive in nature being produced from this power of different bodies being able to break up light and to absorb some of the hues and to reflect others. For example, a " red poppy " possesses the power of *absorbing* the green and violet rays of white light, and of reflecting back again to the retina nerves of our eyes the *red ray*, hence the poppy appears *red*; and so on with " green grass "; this substance absorbs the *red* and *violet* rays of the light which falls upon it, and reflects back to our eyes the *green rays*. This same law applies to all other coloured substances in a corresponding effect.

If, however, a substance is so constituted that it *absorbs all* the coloured rays of the light, then it will appear " *black* "; but if, on the other hand, it *reflects all* the rays, then that substance will appear " *white*."

Now the three printing colours used for producing a multi-colour picture in but three workings are termed the "three primary pigments"—"yellow," "red," and "blue." Thus the *three primary pigments* differ entirely to the *three primary light sensation colours*, which are "Red," "Green," and "Violet."

This is explained somewhat in the theory that when making the negative for the yellow printing plate, the yellow that appears in the copy should not affect the sensitive plate, but should be the transparent part of the negative.

The same in regard to the blue printing plate. The blue in the copy should not affect the sensitive plate, due to absorption by the colour filter, and is thus represented by transparency, or absence of silver deposit on these corresponding parts of the negative. Likewise with the red printing plate.

We have just observed in brief outline form, how that the art of photography and the applied "laws of light and colour" were made to serve the lithographer, in conjunction with metal plates, for the production of chromo printing surfaces.

The metal zinc is the one that is exclusively used for this "Frey" photo-chromo process, being selected in preference to either aluminium or stone.

The reason does not exist in the mere cheapness of the zinc plate as compared to the aluminium one. It is due rather to its more accommodating conveniences.

In the first place, the zinc plate is more amenable to certain corrective trade requirements, and can be treated more nearly akin to the lithographic stone manner than the aluminium, on account of this metal being more readily acted upon by the alum acid bath.

For example, whenever it is necessary to remove any portion of the work from a zinc plate for alteration or correction purposes, that can be done—wherever thought advisable—by means of a slip of "snakestone" (water of Ayr pencil), just as one would employ for a similar purpose on litho. stone.

Although the grain of the zinc plate in those polished parts would be thereby destroyed, it can be again restored there in a couple of minutes, by means of the " alum acid bath " (affinitiser).

A similar freedom of treatment cannot be equally well practised in connection with the aluminium plate, as a smoothened part once made upon it, is not so easily or readily roughened again; consequently, any parts made smooth by erasure or cleaning-up methods produces a corresponding difficulty to the printer in maintaining an efficient supply of moisture upon them and thus preserving them from degradation and soiling of the " lights " of the image; or, as it is more aptly termed in shop parlance, a " scumming " or " catching " of the work. The reason, of course, being that the rough surface of the plate acts as a form of " reservoir " for the retention of the damping moisture so essentially requisite in this " planographic," or " flat surface " printing method.

Moreover, the " inking-up " of the image is somewhat more easily accomplished on the zinc plate after the " washing-out " operation—especially so as regards solid, heavy work, which rolls up much more quickly than is customary for similar work on an aluminium plate. Why this is so, is explainable by the different physical properties of the two metals.

While decidedly preferring the zinc plate to the aluminium one for the many conveniences which it affords, we do not for one moment wish to infer that aluminium plates will not give good results in capable and experienced hands, as we know that such is the case in both the American and European continents. We have ourselves *done all classes of work on both metals* for a good many years, but what we do wish to affirm is, that one can proceed more freely and uniformly with the heavier metal for *photo-process work*, than with the lighter one, and hence it is recommended in preference.

All the same, let those who have not had the advantage of a mixed experience be not deterred (if oppor-

tunity affords itself) from trying both metals, if only for their own instruction's sake.

Those who are already proficient with aluminium will not be disposed to hastily discard it without fully assuring themselves of the benefit to be derived from so doing. Many firms still prefer it to zinc. (See Algraphy pictorial supplement in this book, which was photoed upon, and printed from aluminium plates.)

Before dismissing the "Frey" process on zinc, we may here remark that the fine tone grain of this method furnishes one of the most delicate forms of litho-transfer; it is therefore in itself most educational to the young lithographic printer in regard to the treatment of it for procuring the best results, as it affords him the "cue" as to procedure whenever he himself may be engaged in a similar range of work, or desires to practise photo-process methods for himself. The transfer paper that gives the best result for this photo-grain work is a soft-faced coated paper like copperplate transfer paper, or a good "Everdamp." The "proving" of this work is done at the hand press, often immediately after the plate has been finally etched.

Papers such as the glazed "oak varnish" paper, and the thinner qualities of the "French transparent" transfer papers, do not afford the transferrer the fullest satisfaction for this fine grain, and should be passed over.

A smoothened surface transfer paper, such as the "white Kaolin" transfer kind of Continental make, may also be used, but does not admit of any great latitude of moisture on the plate when "pulling" or "putting down" the transfer, on account of the adhesiveness and plucking propensities which it displays.

When these "opaque" transfer papers are used, the "shining-up" frame must be strongly illuminated from below, so as to produce translucency; whilst right angle "register marks," and "corner" angles are resorted to as the most efficient guide for attaining

correct register in the " sticking-up " of the various individual transfers upon the " key " sheet.

Usually a small portion of the corner marks are cut away to give a more visible guide to the transferrer in the " shining-up."

All the other conditions of the transferring are in conformity to the ruling principles we have already dealt with.

CHAPTER XVIII.

LITHOGRAPHIC TRANSFERRING BY SPECIAL PHOTO-MECHANICAL METHODS—THE "PRINTEX" ECONOMIC PHOTO-MULTIPLE TRANSFERRING PROCESS—TUBULAR TRANSFER MACHINE.

THIS is a novel process in which "photography" is utilised to produce the *duplication of original lithographic transfers*; and to become a *transferring agency in lithography* in place of the time-honoured hand manipulative methods hitherto in vogue.

By this "Printex" process, actual and entire productive printing surfaces are obtained, correctly "duplicated-up" from one original, and which are available for different printing methods, such as the "Planographic," or "Flat surface," as represented by *lithography*; the "Relief," as represented by *typography*, and "*Photo-engraving*"; and "Intaglio," as depicted by *photogravure* and *Docteur calico printing*.

This is accomplished in infinitely less time; with better results; and at less cost, than can be done by any of the older methods which this process was designed to displace.

It is done by the combination, and economic utilisation of special mechanical and photographic appliances, known as the "Step" and "Repeat" machine, and "Rotary Transfer machine," ingeniously devised to quicken and perfect certain essential and indispensable processes of the printing crafts.

By these means any given number of original transfers can be automatically reproduced by photography upon a machine printing plate, for utilisation in unlimited, productive, lithographic printing purposes; each of these transfers being actually as sharp as the

original from which they were made; whilst by virtue of the photographic basis of the transferring operations, the stability and longevity of the work upon the printing plate or cylinder, is more invulnerable than that produced by hand transfer methods.

Practically all the transfers are *originals*, which is equivalent to printing from the original image.

In the most difficult and important phases of transfer work, such as the all-over patterns and designs as utilised in "wall-paper," "linoleum," and "book cover end papers," as well as in "textile fabric printing," which require mathematical repetition and precision in the joining-up; here the autonomy of this process removes all possibility of error and affords perfect results, outclassing any of the preceding hand methods connected with this range of work.

A sheet of a thousand duplicated transfers, as done by this process in three hours, would take a litho. transfer staff twelve hours to accomplish.

Again, under the old régime, if a machine plate should become spoilt, and another one had to be prepared, it would take the transferrers just as long to produce this second plate by ordinary lithographic means as it did the first one. This applies equally to printing plates that may have taken three, four, five, six, or even ten hours to produce.

With this method, once a plate has been produced, it can be reproduced again in thirty-five minutes, no matter how complicated the design may be. Thus the comparison is phenomenal.

No atmospheric or weather considerations affect the result, which are equally attainable either in the depths of winter or the heights of summer.

Microscopic register is assured even in the most humid atmosphere, or arid climatic conditions.

Flat plates up to 60 by 40 size for the lithographer can be made, and also *tubular printing surfaces*, both for the lithographer in the "all rotary, reel printing method," and for the "intaglio" reel printer as well.

To accomplish this there has been devised a specially

articulated transfer machine, which enables them to accurately and completely join-up the most complicated and intricate designs.

Below we give a brief description of the working methods of this process :

Modus Operandi.

First a negative is made of the copy that has to be reproduced. From this, a "transparency" (diapositive) is made by contact.

This "positive" is then affixed in a special machine, known as the "Step and Repeat" Camera. The mechanism in this apparatus is wonderfully articulate and precise.

The focussing for "correct size" and "position" is done through this positive upon the ground glass screen at the front of this repeat camera.

Afterwards, the focussing screen is removed, and a sensitive photographic plate inserted in its stead.

The first exposure of the unit image is made upon the left-hand upper portion of the plate; then, by revolving a controlling wheel a given number of turns, everything is ready for a second "step" exposure, to be made upon the next adjoining portion of the sensitive plate; and so on by repeated "steps" and "exposures" right along this top strip of the plate.

When this is completed, another wheel is operated, which brings the next successive *linear area of the plate* into position for the second line "step" and "repeat" procedure; and so on until the whole plate is covered with the pre-arranged number of repeat images which it has to receive to complete the negative.

It is next developed and fixed, and is then ready for placing upon an "albumenised sensitive zinc or aluminium plate," for the production of the actual printing surface required for the machine.

After the final lithographic etching operations, etc., the plate is ready for printing from.

If the lithographic printing surface should be a *rigid tubular one*, instead of being a loose flat plate, here

this company have devised a special piece of machinery to negotiate this, which is designed to work to a micrometer nicety of precision.

In structure this TRANSFERRING MACHINE has the outward appearance of an ordinary "flat-bed lithographic machine." Concisely, it possesses a cylinder clothed with a three-ply rubber blanket, and an iron bed for holding the zinc plate carrying the transfers—prepared through the agency of the "step" and "repeat" machine.

The work upon this plate is inked-up with retransfer ink, and then an ink transfer from this plate is made upon the rubber-clothed cylinder. The clean tubular printing surface having been previously affixed into journals connected up with the rubber-surfaced cylinder.

Then by means of a lever motion, this metallic printing tube is brought down into the correct contact position upon the rubber, and the transfer thus made upon it.

Now we approach the explanation of a remarkable feature of this machine. As these different tubes may vary up to perhaps a quarter of an inch in circumference, this difficulty has had to be negotiated in the construction. It is accomplished by having a "duplex gear" fitment made upon the carriage and cylinder, so that the carriage can be made to either travel a fraction *slower or faster* than the cylinder to accord with the exact diameter of the printing tube.

It must be explained that this is done by throwing the finer gear slightly out of the parallel direction. Thus, if a transfer plate has an image upon it which measures 20 in. and the circumference of the cylinder is only $19\frac{3}{4}$ in., then this quarter of an inch is by this device *absorbed* in the retardation of the travel of the carriage in conjunction with the "yield" of the rubber blanket. And so on for the inverse condition, when it would be made to *gain* a quarter of an inch creep in the 20 in. circumference.

This process equipment, including the "step and

repeat" machine, etc., is supplied to lithographic establishments on terms of an annual licence, by the "Printex" Co. Ltd., Central House, Kingsway, London.

The accompanying specimen plate of the "Wood Nymph" was produced by this process in two colours, being a half-tone, 150 line ruled screen image upon a zinc plate, and printed lithographically; the two extreme units at the bottom portion of the plate show the analysis of the two colours, the tint, and the body colour, and show the superior manner in which lithography can print process half-tone work on plain paper.

CHAPTER XIX.

THE "VACUUM" PLANOGRAPHIC TRANSFER PROCESS—DIRECT PHOTOGRAPHY UPON LITHOGRAPHIC PRINTING PLATES FROM BLACK IMPRESSIONS—THE THREE PHASES OF THE VACUUM PROCESS.

THIS new transfer process, known as the "vacuum"—the name being derived from a piece of apparatus used in the process—produces *Planographic printing surfaces*, either in "single" colour, or "multicolour"; ranging from "pages of type" to a "chromo-litho print," ready for direct use upon the "rubber offset machine," the "direct rotary litho.," or the "flat-bed litho. machines."

The printing image produced by this process is of a "light," sensitive, colloidal basis, and is consequently of a much more *serviceable*, and *durable* character, than what the "ordinary grease transfer image" is. It adheres to the surface of the metal plate infinitely more tenaciously, and will successfully resist the roughest treatment of the printer at the machine.

This point will be fully understood when we explain that the "minder" could safely rub over the surface of the image upon the plate with a piece of flannel, saturated with "caustic potash" solution, *without in any way impairing the transfer*. Such treatment to an ordinary greasy ink transfer would be fatal.

There is thus no risk of the job "wearing away," even upon the longest runs, as a quarter of a million impressions have been done from one plate, so that no delays need occur to "doctor-up" the work.

The printing image is produced upon the plate without the aid of "transfer ink," or "transfer paper,"

and is accomplished in a *quicker* manner than by the old, orthodox hand transfer method.

Transfers of "half-tone" work or "line" work are produced direct upon the printing plate from BLACK IMPRESSIONS, and are absolutely *facsimile* reproductions.

This being a "planographic process," the self-same metallic printing plate can be used over and over again indefinitely for fresh jobs, and in the most expeditious, and economic manner, just as in ordinary lithographic procedure. This is done without there being any appreciable loss of metal, whilst the metal itself (zinc) is one of the cheapest procurable.

Contrast this condition with a "half-tone" relief image etched upon copper: in this case the plate is then unfit for further work, as the surface is irretrievably consumed in the "relief" etching procedure.

It thus follows that all forms of letterpress work, such as pages of "type" and "half-tone images," and all other forms of "relief" illustration work, can now be reproduced at one and the same time, upon a litho. zinc plate, and printed from a lithographic, mechanically fed machine, at a higher speed than what is attained by letterpress machines; thus lithographers can capture letterpress work for machine printing.

There is no loss of time by "make-ready," or "under packing," or "interpacking" of blocks, as in typographic methods.

This "vacuum" process covers *three phases* of planographic printing surfaces.

First, it produces a *facsimile true to scale of monocolour printing surface*, transferred direct from the originals, reprints, or reproductions, either upon zinc or aluminium plates.

Secondly, it comprises a direct *photo-chromo transfer* process, in which coloured originals are reproduced upon the tricolour basis. This process embodies a special method which enables the litho. artist to correct his colour values direct upon the metal plate, and which is more proficient than the "fine

etching" method, as it enables "increased shading," or pure "high lights," being attained at will for the production of greater contrast.

The *third attainment of this process* is that of a special "photo-grain" method for producing the largest lithographic posters, either in "one" or "many colours." This grain approaches that of the lithographic chalk grain in character, though produced without a screen. The texture of this grain can be ordained for any size of reproduction.

THE RATIONALE OF THE PROCESS IS AS FOLLOWS: A zinc machine plate is coated with a "special sensitiser," whirled, and dried.

It is then placed "coated side up" in the "vacuum" printing frame, and the sheet of black or bronzed impressions laid on, in the correct position.

The vacuum is then effected by the motor pump, and the plate exposed to the Hewitt-Cooper lights for about six minutes.

It is then *washed* and *dyed* in methyl violet solution, and dried. There is so far produced a *negative image*. This is now transformed into a *positive one*, by first flowing over the plate a powerful asphalt-like fluid. Next, the negative image formed by the sensitive glue is removed, when the plate is treated as an ordinary transfer by etching, gumming, etc., and is then ready for the machine.

Thus this process helps to develop the transfer department nearer to the requirements of the machines.

An example done by this process appears in this book as a typical colour supplement.

In regard to these latter aspects of "metalithography," such as the "Printex," the "Frey," and the "Vacuum" processes, etc., there never was a period in the whole history of the craft in which such powerful and epoch-making discoveries and inventions were successfully ushered into it, as what we are now every day witnessing with these various photo-process triumphs of lithography, which have already revolutionised and economised the *transfer* department of the

business, so that it now synchronises more equally in production to the requirements of the recent, rapidly developed, machinographic end of the craft; and this makes the advance of lithographic attainments more general and complete in all its various subdivisions. Long may this continue.

Photo by J. Goodman

METALITHOGRAPHIC PRINTING MACHINE SECTION.

CHAPTER XX.

COMPARATIVE ANALYSIS OF MACHINE TO TRANSFER SECTION—FLAT-BED RECIPROCATING LITHO. MACHINE —CONVERSION FROM STONE TO PLATE WORK—GLAZED SKIN OR RUBBER INKING ROLLERS.

THE preceding chapters having been devoted to the preparation, and production of the metallic printing surface, by all the various sources (so far as relates to the transfer and artist branches of our craft), we now direct our attention to the other interesting and all absorbing branch of the trade; that of the "Machine Minding" section, or "Power Press" department, as it is oftentimes called.

The old adage that "comparisons are odious" is no doubt generally true, but, like most other considerations, there are times when this generalisation must be suspended.

It is with these reflections running through our mind that we are bound to affirm that the "Printing Machine" section of our craft is the "major" element when weighed in the balance with the transfer section.

From point of numbers alone, the machinemen outnumber the transferrers, though the proportion may not always be as great in the near future. The trend of trade developments have heretofore been that the machine department became more and more productive, due to the *ever-increasing speed capacity* and *productive conquest of lithographic mechanics*. Therefore, where hitherto a single transferrer was quite capable of getting enough work ready to keep two or more

FIG. 32.—FLAT-BED LITHOGRAPHIC MACHINE.

machines in full swing; where the plant was of the old reciprocating, "flat-bed type"; it follows as a natural consequence, that when these slower types of printing machines are replaced by a faster type, such as the Rotaries, then much more work is required to be got ready to satisfy them, and keep them running; and the transferrer has to "run down," and make ready, many more plates than he was previously called upon to supply, under the older conditions of affairs.

Although it is possible to keep on improving the speed and the productive capacity of machinery, there is not the same scope of multiplying the human capacity in the equivalent direction; the maximum output of human manual energy and skill, is soon reached; and unfortunately can soon be overtaxed, with a consequent breakdown altogether.

Thus it is that the relative proportion of machinemen to transferrers is to-day very different to what it was only ten years ago; and the tendency had all been bearing toward the transfer section of the business, until quite recently, when those new photo-transfer processes, the "Printex" and the "Vacuum," were created with the object of speeding-up the transfer department, so that it may now more nearly equalise to the prolific capacity of the machines.

From another point of view the machine department is all-important; it is the "camel that carries the load." Here it is that the work is actually produced; the money-making end of the business.

The transfer department truly does the initial preparation for this, but it is the machine end of the business where the actual creation takes place, and the commodity has its being, upon which the revenue is levied.

It is here that the proprietor hears the sweetest, loyal music—the rhythm and whizzing of the willing press. Every revolution speaks grist, either good or bad. Good, if the operator is skilled and expert at his business. Bad, if he is incompetent and slack.

It is here also that the human element commands a

higher remuneration for his services, than is customary at the other end of the business.

Here again, the greater and overwhelming part of the capital investment is involved. *Costly machinery*, as well as *more costly labour*, all play their part in adding to the preponderating importance of the machine room of every successful lithographic business in the world.

It is in the machine room also, that the great mechanical developments of the trade have transpired. The humble, but nevertheless invaluable old "transfer press," has seen but little change or alteration in its construction for the last thirty years. But not so with the machines which have incessantly and magnificently improved.

Printers' engineers give the most fervid attention to the printing machine room, where most remarkable and revolutionary developments have unceasingly ensued during the past quarter of a century.

So much so has this actually been the case; and so marked is the contrast with "what once was," compared with "what now is," that it almost baffles the human mind (no matter how well trained it may be in matters printorial), to conceive of what the ultimate outcome of this growth may eventually be. The precision of the lithographic machinery of to-day is astounding, and will vie for development and progress with that of any other branch of mechanics; or most favourably compare with that of the mechanical appliances of any other branch of the printing world.

While such enterprise is identified with our craft, and such ingenuity is being dowered upon it, with the enthusiasm which is now becoming so characteristic of our modern trade surroundings, we may look the future in the face in pleasant anticipation of its prosperous and most happy consummation.

In order that the young lithographic printer may be guided and helped in the most trying part of his career; at that period when he is struggling to get a grip of things, and where he lacks accumulated experience to

help him over many difficulties in "Metalithographic" matters, we shall here endeavour to give him the benefit of our help, by placing at his service the outcome of a long and unique practical experience in the machine rooms of some of the best establishments of the lithographic trade in Europe.

If, as is so often the case, the litho. printer should commence his metal plate work experience upon a flat-bed machine, he will there encounter many difficulties that are non-existent upon a well-ordained rotary lithographic machine.

In the conversion over from stone to zinc, or aluminium plates, he is frequently expected to be able to sail along smoothly with just the usual stone equipment, instead of being supplied with the modified appliances which are so essential to good plate printing. For example, in the matter of inking rollers, and adjuncts for ink, iron plate bed, etchers, and cleaning-up materials, etc. His damping rollers should be made soft and resilient, a brass rider being worked upon them for stripping off any adhering ink.

"Grit" falling upon glazed rollers produces scratches in the plates much more fiercely than what would occur where nap ones are used.

The flat-bed machine minder must be careful to adjust the *inclined roller planes* at each side of his machine (both gripper and back edges), so as to minimise the "bump" and friction of the rollers when passing on to the printing plate at each transit of the machine carriage.

In printing short runs of "autographic" or cheap "commercial" work, it is not always necessary to fasten up the back edge of the plate upon the iron plate bed in a flat-bed machine, as it will run all right if just left loosely bent over the back bevel; provided that the front gripper edge is securely fastened. This enables an expeditious change of plate to be effected for "rush" work.

There is one class of work done from zinc plates upon the flat-bed machine, in which it is a decided advantage,

to have the printing image etched very slightly up into "relief"; and that is the "coloured felt" printing work, in which four or five colour lithographic designs are printed upon sheets of "felting," which are then utilised for making "slipper tops," "wall pocket fronts," and "tea cosy covers," etc. This enables a solid impression to be obtained with the use of less ink.

To accomplish this the work, after being transferred down to the plate, is well rolled up in black ink, then dusted over with colophonium powder and French chalk; the plate is next warmed to fuse the powder, when it is immersed for three minutes in the "affinitising" bath, and then well washed, and etched with any good etching fluid, and is then ready for printing.

Although smooth "glazed roller skins" are satisfactorily used for printing colour work from litho. stones as the printing surface, they are quite inadequate for use upon the grained metal plate surface for similar work.

The hard skin of the glazed roller never appears to get a proper grip of the surface of the metal plate. Beyond this it smooths the plate surface, by rapidly burnishing down the grain. Nor does it deposit the ink from its surface upon the image of the printing plate, as it does upon a smooth stone face, because in the use of the stone, the image is lying upon a smooth polished plane; whereas in the case of the metal plate, the image is lying upon a roughened, grained surface.

The best type of roller to use for all kinds of metal plate work is the NAP LEATHER ROLLER. Failing this, then the rubber roller is by far the best substitute. These may be either of the "grey" or "red" type. We prefer the "grey rubber" if it is well made, as it is more durable, and less susceptible to softening and dissolution.

CHAPTER XXI.

SUPERIORITY OF NAP ROLLERS—COMBINATION OF NAP AND RUBBER INKERS—CANADIAN-AMERICAN ROLLER CLEANING APPARATUS.

It is a good practice to employ a combination of both "nap" and "rubber rollers," if all nap ones are not available.

To give best effect to this combination, we arrange that the "nap rollers" shall be placed at each exterior of the set; that is, that the rubber rollers shall be *sandwiched* in between nap rollers, so that the *first* inking roller that comes in contact with the printing plate, as the cylinder revolves round with it at each transit, is a "nap" one; and the last one to leave the plate is also a "nap" one. So that, taking as an example a complement of six inking rollers being upon a direct Rotary machine, the first roller of the set is a "nap" one; this is followed by four "rubber" ones, and then finally another "nap" roller to complete this set of inkers.

The foregoing proves to be the most serviceable arrangement of the combination, and is the nearest substitute to a full nap set of inking rollers as recommended.

There is always a complete set of nap rollers furnished with the equipment of a new lithographic Rotary machine, and, if the disposition of these is so arranged as we are here about to suggest (and which is now actually being followed out in various Continental and English litho. establishments) there will be a great saving and economy effected in the matter of "changing colour" (and that is a formidable item on rotary machines), as well as efficiency in the inking-up of the work at these machines for printing.

Should the complete set of these nap rollers comprise eight inkers—as it does on some makes and sizes of machines—then two of these are set apart for printing *yellow and orange colours*, and are thereafter restricted to that range of colours alone.

Another two of the same set of eight are set aside for the printing of *red colours*, such as vermilion, crimson, scarlet, madder, etc.

The next couple are reserved for *blues*, Chinese, bronze, royal, ultramarine, etc.

The remaining couple are allotted to the printing of *browns*, chocolates, greys, etc.

To illustrate the utility of this procedure, we will describe in brief detail what actually transpires when carrying through a new job for colour printing under this arrangement.

Assuming that yellow is to be the first printing (as it invariably is under normal conditions, excepting where a "bronze" or "light blue" tint may occasionally be printed first), we take the two nap rollers, which have been assigned for the printing of yellows, and place them in the machine in their respective positions of *first* and *last* inkers. In between these two extreme positions we place the rubber rollers in the vacant, intervening roller sockets.

In this order we charge our rollers with ink, and carry out our printing of this yellow colour of the job in hand by this arrangement. When the run of this colour is completed we simply scrape the two nap rollers in the recognised manner of the trade, which is not a very formidable task, and most speedily accomplished by a skilful craftsman, or, better still, they may be washed in the roller washing apparatus, as referred to later on.

They are then set aside in the stores roller rack to await the next demand upon them, whenever a yellow or orange colour is required to be again printed in the machine.

A competent litho. printer never thinks of adding a drier to a yellow ink, but on the contrary always adds a non-drying oil to this colour, so as to cause it to sink

as much as essential into the paper, instead of drying hard upon its surface, in which latter condition the remaining colours would fail to lift upon it. There is thus not much liability of the mere stain of yellow ink that is still retained by the nap of these rollers—if they should have been scraped only—setting hard, or skinning upon them, if they should be put away without being tallowed over, as a final treatment.

The intervening rollers being rubber, are easily and quickly washed up; infinitely quicker and cleaner than nap rollers would be if used in lieu of them, and con-

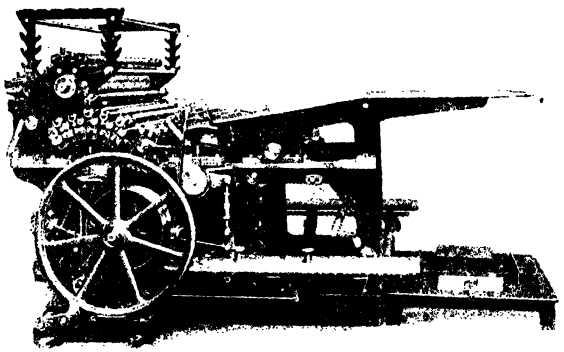


FIG. 33.—DIRECT ROTARY (FURNIVAL & CO. LTD.).

sequently the machine can be got ready for running again upon the next colour so much more expeditiously than would be the case were all nap rollers used instead of this *combination of rubber and nap* as here outlined.

If the second colour of the job should happen to be a *red*, then the two nap rollers set aside for this range of colour would be taken from the storage rack and placed in position in the machine, just as the "nap" yellow ones had been done for the previous colour, the rubber ones filling in the intervening vacancies as before.

And so on with the "blues" and "browns" of the job. Each set of two naps being placed in succession

in the machine for their respective colours, as was previously done with the earlier colours.

The saving and economy effected by this method is palpably apparent, when we consider what the trouble would have been, if there were only one set of nap rollers for all the colours.

The time and difficulty that would be encountered in cleaning up these myriad tongued rollers by hand method alone, from say blue to print a red, or a yellow, would well disorganise the patience and temper of the "mildest mannered Quaker," much less that of a highly strung "Senefelderian."

As it is, with this combination method, one set of nap rollers caters to all these divergences of colour and affords a speedy system of change of colour.

Whenever the next yellow colour job has to be worked in the machine, it is then only necessary to take down from the storage rack the two nap rollers reserved for yellow and put them into the machine in place of the two that were used for the last colour just completed.

The smooth-faced rubber rollers in the meantime being cleaned up for this fresh colour.

This, then, is one convenient method of grappling with a rather formidable difficulty in rotary press work.

In cleaning "nap" rollers by hand, they are usually first sprinkled over with turps, and then rubbed with a piece of cabinet paper wrapped round a wood block. They are then scraped with a blunt, flexible knife.

Another method is to use a medium bristle nail-brush and turps, followed by scraping.

CHAPTER XXII.

DUPLICATE COLOUR SETS OF NAP ROLLERS—AUTOMATIC ROLLER CLEANING AND GRAINING APPARATUS.

A MORE perfect method, however, yet the most costly, is that of having a number of sets of nap rollers for the chief colours used in chromo printing. For example, one complete set of nap inkers for yellow, one for blues, one for blacks, and one for reds, etc.

This involves very considerable initial expense, which few firms outside the pale of the most wealthy ones care to embark upon, as it also entails large storage space to rack the rollers.

Where this is carried out, then the most delicate work upon the plate receives the most efficient treatment, affording the most satisfactory results in printing, as "nap" rollers enable this to be attained.

In this method, upon the completion of the run, the inking rollers are removed from the machine, and then cleaned up by a competent assistant, who is retained for this work alone.

The machine in the meantime is utilised without delay for the next job, by putting on right away the set of rollers kept for that particular colour that is next to be printed.

In this way the inking rollers just used for printing the last colour are cleaned up ready for another occasion, while the machine is being run for the succeeding colour, whatever it may be, and thus the machine is not kept standing for any length of time, due to the rollers having to be got ready for it, as each set for their respective colours are ready waiting in reserve in the roller rack for immediate use.

On some makes of machines that we are familiar with, the manufacturers rely upon "rubber rollers"

right through, both inkers and distributors, and as a solution to the glazed roller convenience for washing-up; they are an excellent substitute in that respect. There are, however, other conditions to be negotiated, such as long runs, full depth of colour, or "tinctorial power," and the freshening up of the colour from its susceptibility to the damping water, as well as trouble

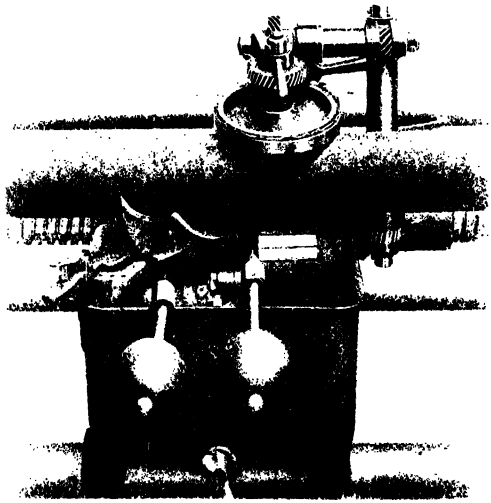


FIG. 34.—CANADIAN-AMERICAN ROLLER CLEANING AND GRAINING APPARATUS (DETAILS OF SOLVENT TANK, SCRAPER BLADE, AND DISC HEAD).

from grit particles becoming embedded in them, all of which are associations of rubber rollers.

As a practical solution of this roller cleaning problem the litho. roller graining and washing machine, as illustrated in our advertisement pages, has proved one of the most profitable adjuncts to a lithographic plant that has been offered to the trade in this direction, and has been already adopted as such by the leading British and Continental lithographers.

It will not only clean and grain a roller in a couple of minutes, and this without the use of rags, returning the solvent for use over and over again, but owing to the nature of the mechanism, the wastage of leather is infinitely less than when scraped with a knife, while a true surface with its largely increased inking capacity is assured.

It will clean rotary or flat-bed, nap, or glazed rollers equally well, and the question of colour is arranged for.

It is claimed that it will save its cost within the first year's use, besides doubling the working life of the rollers, as, instead of sending them for new skins, the machine will get up a velvety nap on a roller skin that under old methods would be discarded, besides saving from one to two hours in the washing-up of every litho. rotary press in an establishment.

The tank fitment (Fig. 33) can be raised or lowered instantly, to adapt it to any diameter of roller to be cleaned.

The solvent carrying roll is so balanced that it is brought into contact with the litho. roller whilst itself revolving in the liquid, thus carrying the solvent up to the skin roller, which is thus evenly moistened. A dull crescent-shaped blade follows the roll the length of the lithographic roller and scrapes off the solvent, which runs back into the tank for use over and over again. Rags are entirely eliminated in the cleaning of rollers by this device.

The graining-head—or carborundum disc—revolving horizontally to and above the roller, is brought by hand against the surface of the revolving skin, and whilst thoroughly cleansing it, imparts any desired nap to the roller.

The sole manufacturers of this apparatus in Europe are the Canadian and American Machinery Co. Ltd., 8, Bouverie Street, London.

CHAPTER XXIII.

MANY rotary minders "clean up" from one colour to another by sprinkling "paraffin," or "rubber wash" upon the rollers, and then "sheeting-off" the dissolved colour from them, by "mangling-in" a number of waste sheets to absorb the colour.

Sometimes they afterwards "run up" the rollers in the new colour, then resheeting as before. When this method is used, it not infrequently happens that a large number of waste sheets have to be run through the machine after the "fit" has been obtained, in order to overpower the tinge of the previous colour, before the correct shade of the new colour has dominated precisely.

The point to be driven home, then, in connection with the inking arrangements for metal plate printing on rotary lithographic machines is, that the essentially roughened nature of the aluminium or zinc plate surface demands being fed with a roller which imparts a velvety touch to the tooth surface of this metal plate; and not with one of a hard, smooth, frictional surface, which has the effect of *burnishing the grain*, making the plate surface *smooth*, instead of *rough*- in which state it is incapable of retaining an adequate amount of moisture for perfect printing conditions.

The roller surface must be such as to gently yield or give to the granular character of the printing surface; otherwise it will continuously attack the apexes of the grain, producing a deteriorating, flattening effect upon the plate, through the summits of the grain.

The conditions are identically akin to those which prevail with a "grained litho. stone" and "chalk work." Here no competent printer would ever undertake to produce the best result, unless he had a good

set of *nap inking rollers* for his machine, to enable him to do this chalk work properly.

To make the attempt with the use of smooth-surfaced, glazed ones only, would simply result in debasing the graduated grain character of the work, and fail to give the values of grain which are the crux of the process. Logically speaking, it would be of small avail to draw chalk work, if chalk effects could not be reproduced in printing, solely because the essential conditions had been ignored.

And so it is with "metalithography," where grained, or rough-surfaced, metal plates are an absolutely integral, and indispensable part of the process.

The physical and operative conditions, as well as the character of the work itself, is much upon all fours one with the other—of these two granular, lithographic printing surfaces, "grained stone," and "grained metal."

They both require for their most perfect inking and working conditions that peculiar *cushion touch* and *furry surface* which is so characteristic a feature of these "nap" rollers, and which it is sought to embody in the inking rollers of rotary litho. machines; so that the tongued granular surface of these rollers will be able to automatically mould themselves amidst the irregular, granular surface of the plate, instead of skimming over it, or skidding, as smooth-surfaced rollers are so prone to do.

In this connection there is one most marked and salient difference between stone and plate; that is, the grain of the metal plate is much more easily and rapidly flattened, and smoothened down during the natural attrition of working conditions than what the grain of the hard lithographic stone is capable of.

This factor makes it the more imperative that every possible provision that can be made, should be done, in order that the grain—which is so indispensable a condition of metalithography—should be maintained, and preserved, throughout the run.

"Nap" leather rollers are more congenial to the

roughened plate surface in this respect than what the other kinds are. They freshen up the printing ink much better, and resist the deteriorating effects of the damping water much longer, besides recovering themselves from the effects of over-damping very much quicker than what other kinds do.

The *tongue of the nap* accords itself more to the tooth of the aluminium plate than what smooth-surfaced rollers can possibly do. They also carry a better reserve of ink amongst the nap, than can be carried with smooth rollers; consequently they do not choke up the work upon the plate so quickly as any other form of rubber, or skin rollers do, whenever they may be inadvertently overloaded with colour.

In "washing-up," the "rubber" rollers have the advantage, as have also the "glazed" rollers; but these latter lack the softness and elasticity which the rubber ones possess, so are not of practical service for long runs of aluminium or zinc plate work.

Some of the finest chromo litho. work ever done in Europe from the "Direct Rotary," and the "Rubber Offset machines," was done through the agency of the nap leather rollers.

Just as the transferrers always use a "black nap roller" for the preparation of the plate for machine printing purposes, in like manner these "nap" rollers serve the machineman in similar stead when they form part of his equipment of the machine.

When it comes to the pulling of transfers for making up duplicate work for the machine plate, there is then no question as to the indispensable service, and the great superiority of the "nap" hand roller, over all other forms of rollers ever attempted for this purpose.

All modern machine makers are aware that both "rubber" and "nap" rollers vary their diameter slightly after having been in use for some time, and have made provision for this, by affording adjustment of the roller bearings accordingly.

It is only natural that both rubber and nap rollers have their disadvantages, as well as their advantages;

it is only by balancing all against all, that we can relegate them to their true relative position. "Rubber" rollers are the next best substitute for " nap " ones. On both sides of the Atlantic the " nap leather roller " is the most esteemed for plate work.

A few words of advice and caution as to the treatment of " rubber rollers " are necessary, as a new user of them may quite unconsciously injure them, although endeavouring to preserve them. For instance, " Benzole " or " Benzine " will digest or dissolve rubber, consequently a repeated use of this fluid for

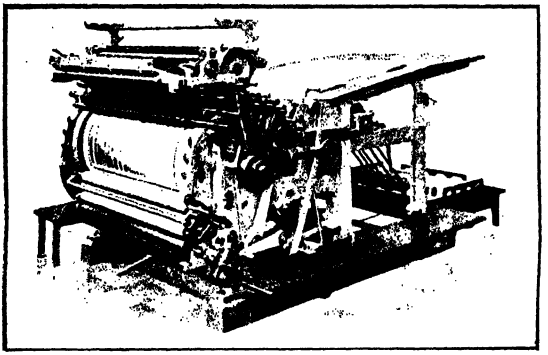


Fig. 35.—Direct Rotary Litho. (Linotype & Machinery Ltd).

washing-up purposes would soon roughen and eat away a thin film from off the surface of the roller.

Turpentine, on the other hand, has a tendency to shrivel the rubber, or to cause cracks or tiny fissures in it, unless used circumspectively.

One of the best proprietary solutions for " washing-up " rubber rollers is that of the " Ipswich Rubber Wash Co.'s " fluid, which is not only a good solvent for lithographic inks, but it is also cheap, and practically harmless for the rubber itself.

If unable to procure these manufactured washes, then " Rectified Naphtha," or " Paraffin," are the next safest solutions to use.

After the printing ink is well washed from off the

roller, it is then finally dusted over with a little "French chalk" or "Magnesia," and again wiped with a clean rag, kept exclusively for this purpose. It is then ready for use again upon another colour immediately.

With regard to the "solid rubber roller," which may have become uneven and humpy, through warping and contraction, there is the choice of two remedies; one is, to have it turned down; that is, to have a thin shaving turned from off it, so as to equalise its surface. Of course, this reduces its diameter and consequently causes increased rolling-in, as the roller surface then carries a less volume of ink than it originally did. This method has also been applied to machine rollers with success, after having the "friction runners," at the ends of the rollers, turned away also.

The other remedy is to have the rollers recast in the mould.

Another important point in connection with the preservation and maintenance of a uniform rotundity of these rubber rollers is, that they should not be left for any length of time with their full weight resting upon the "ink slab" or "plate," as this has a tendency to form *flats* upon them where the pressure has been long concentrated. This reference applies to both the "solid" and the drawn on "skin" form of rubber rollers.

For the same reasons, the steel riders should be removed from off both the distributors—if these are also rubber—and the inkers, each dinner hour, and at the close of the day's work, so that the periphery of the rollers is left free from encumbrance, and undue pressure.

These points may perhaps appear to be trivial, and simple, to the young printer who has not had the opportunity of experiencing the sequel to them; but he may rest assured that if they are scrupulously observed and carried out, they are one of the guarantees of success; and success is never a triviality. In the words of the old Scotch adage, "Many a mickle makes a muckle."

In connection with the " skin " rubber rollers after a prolonged and extensive use, if there should appear to be the least looseness displayed, this slack must be taken up, either by the *repacking* of them, or by the *tightening-up* of the laces at the end. These rubber skins being to all intents and purposes on all fours with the leather skin, so far as attachment to the rollers is concerned.

Another form of roller used for metal plates is the " pneumatic " ones, invented by Mr. Turner, of the Ordnance Survey Department of the British Government.

They have been largely used for " line " and " tint " work, such as " map " printing.

In these, the tautness and resiliency of the roller is obtained by means of an air cushion—compressed air. A thick inner rubber tube is connected to the iron stock or shaft of the roller, and is operated by means of a valve and pump, after the style of bicycle tyres, so that it is blown up taut.

Outside of this, and lying in between the outer cover and this inner tube, is a thin sheet of celluloid wound round the rubber in two or three folds. The outer cover is usually of " nap calf skin," although there are also quite a number of outer rubber skins in use in connection with this patent roller, in lieu of the leather ones.

A special self-closing valve is part of the equipment of these pneumatic rollers.

They need occasional repumping, or reinflating, to keep taut, and are rather apt to get out of order quickly—at least, that was our practical experience of them. Otherwise they afford the most delicate and elastic feed touch of any kind of packing yet devised.

Messrs. F. Horsell & Co., of Leeds, have also made a pneumatic inking roller.

The value of the rubber rollers over the glazed ones lie in their being so much more supple, and pliant, on the grained plates, than what the hard surface glazed rollers can possibly be, due to their flint-like, unyield-

ing, smooth face. In successfully working a direct rotary litho. machine, the minder must attend to the following items: Set the *inking* rollers to the distributing slab by means of a strip of paper or tin feeler; then adjust the riders for contact similarly. Adjust the dampers to the *printing* plate in like manner. Brush and scrape the dampers occasionally to remove scum. Always clean the plate cylinder, and the back of the plate to prevent indentations.

The rotary occupies little more than half the space of a flat-bed litho. machine, whilst its output is almost double. If automatic feeders are to be attached to the rotaries, it is incumbent to select those makes which do not require a lot of delicate adjustment when changing from a thick to a thin paper.

In printing certain classes of enamel papers which are more soluble than others, it very often happens that the plate soon becomes "scummy." This is invariably due to the surface coating containing alum, or similar reagents, in its composition, which gradually senstise the plate surface. Frequent re-etchings are thus made necessary.

For sound, reliable work, we can thoroughly recommend the English-built direct rotary litho. machines of Messrs. G. Mann & Co., Leeds; Messrs. Furnival & Co., of Reddish; and Messrs. Linotype & Machinery Co., of Manchester—from practical experience with them all. They can be had in sizes ranging up to 47 in. by 65 in.

CHAPTER XXIV.

RUBBER OFFSET PRINTING—THE INK PROBLEM—CONSISTENCY OF INKS—A CONCEALED FORMULA FOR REDUCING OFFSET INKS.

ONE of the earliest complaints against aluminium plate prints during the early days of the first introduction of the Direct Rotary machine here, was, that the plate would not carry as full a body of solid ink as what the lithographic stone did: hence it was averred that the plate was incapable of giving as deep a single film of colour, as what its rival printing surface the stone did.

Now a similar complaint has been directed to the Rubber Offset process, but in this instance to the rubber blanket peculiarity. Since the film of ink which is imparted to the sheet of paper in printing by this rubber transfer printing method is necessarily more thin than by direct printing, the colour comprising the image of the print naturally appears more translucent. This is one of the chief troubles which the young metalithographic printer has to grapple with and overcome. The solution to it is mainly deciphered as follows:

Lithographic printing ink, as purchased for "metalithographic" work, is always stiffer in character, as it is received from the ink manufacturer, than the general requirements of plate printing demand; or for that matter, will permit of being used, in the rigid, compact state, in which it is stocked for sale by the makers.

The reason for this is that lithography is a hygroscopic process, and that each tin of ink may possibly be required for use upon *quite a number of different classes of jobs*, and *various qualities of printing papers*, some of them coated papers, others plain surfaced; some of them may be tender and fragile, whilst others again may be tough and coarse.

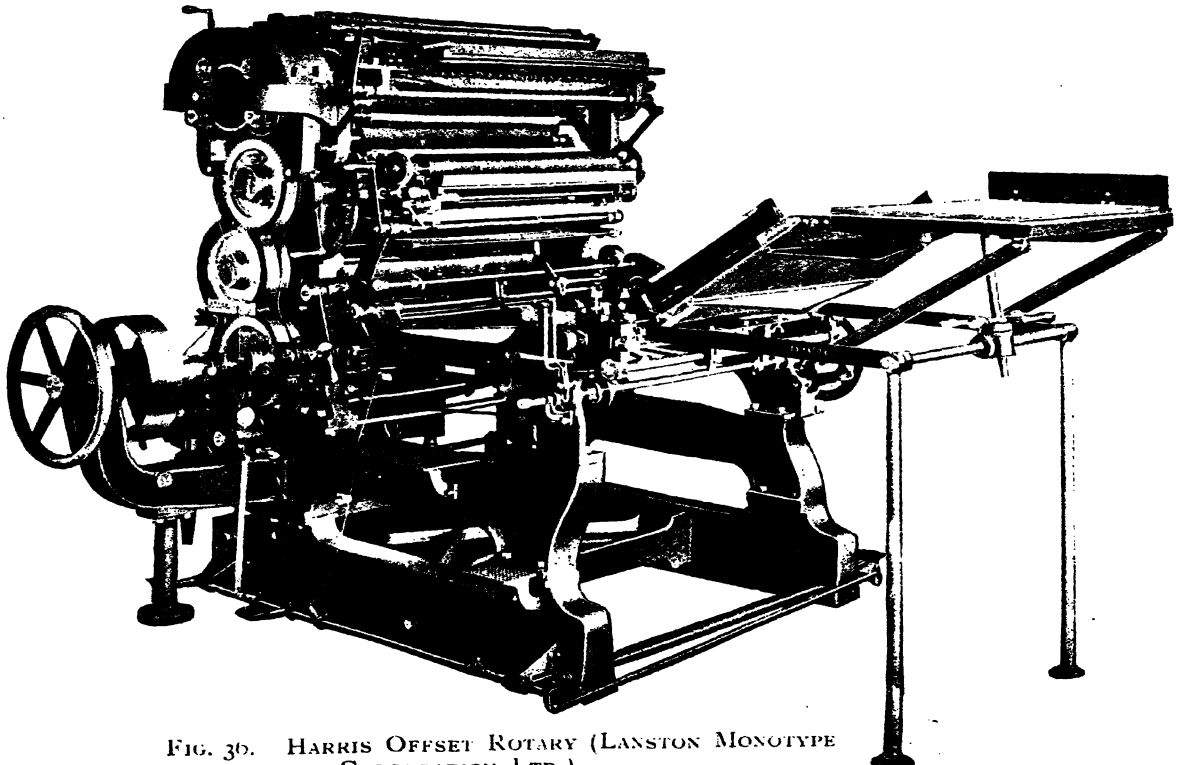


FIG. 36. HARRIS OFFSET ROTARY (LANSTON MONOTYPE CORPORATION LTD.).

In some, the inks may be needed to carry a large modicum of driers; for others, the ink may be required to approach the "sloppy" state, in order to prevent "plucking" or "shredding" of the paper surface. For certain rough kinds of paper a large volume of ink will be demanded, in order to fill the wire mark cavities of the surface of the paper; whilst for "enamel" papers a minimum quantity of ink must be regulated, and of a more rigid state than that which could be adopted for the more fragile, uncoated stock.

Underlying all these variations is the water problem, in which the press operator has to regulate the proper proportion of fatty substances in the ink, to enable it to resist the water effectually, without upsetting the requisite consistency demanded for the particular paper that is being used for the job in hand.

In printing a job in which there is but very little work upon the "forme" there will of necessity only be a very small quantity of ink used to feed the work.

In this case the water would soon gain the ascendant over the ink, unless the press operator takes the precaution to incorporate in the ink a suitable fat to counteract this. Now, it follows that if another job was to be printed in succession to this one, in which each sheet required, say, ten times the volume of ink required for the preceding job, there would be no necessity for using the same powerful fatty body in the ink, as the work of this job would be freshened up with a continuous supply of new ink, undebased with water, and in which the ink would be used up in printing, and replaced by fresh ink each revolution of the press, before the water could react upon it, as would be the case where a mere tinge of fresh ink had to be supplied intermittently, on account of the sparse requirements and nature of that particular job.

It is here where the problem confronts us how best to reduce, and bring each ink to a proper working consistency, to suit each class of work to which it has to be applied, either in direct Rotary, or for Rubber

Offset printing, without impairing the *depth of its srtength*, or " tinctorial " power, so as to conserve the vigour and intensity of the colour when printed; yet at the same time to insure that it will work freely and responsively, so as not to endanger the fine work upon the plate.

The old form of vehicle, such as " linseed varnish," is ineffectual here, as it not only reduces the colouring power of the ink too much, but it also imparts a too viscid character to it for crisp rubber transfer printing.

If, therefore, we can introduce into the ink such fluid substances as will temporarily free it for working capacity at a minimum loss of colouring power, such substances to be of a *volatile nature*, so that when they have freed the ink for distribution purposes, they will evaporate sufficiently to enable the ink to almost recover its original rigid, firm state again, relieved of the reducing disabilities which ordinary varnish vehicles would lower it to, then we approach to the ideal condition and requirements, which is the pressing difficulty of offset printing.

We think that the method which we are now going to describe will prove both helpful and valuable, as it has done in every instance where we have had the privilege of introducing it.

A Secret Formula as Used for this Purpose.—The following ingredients are what are used in mixture form by some very successful houses of rubber offset printers in Great Britain, and which is served out each day to the machine men, ready prepared in small bottles, for them to add to the ink when starting to print.

It consists of these four different substances: *Ether*, 2 ozs.; *paraffin*, ½ pint; *olive oil*, ½ oz.; *oil of lavender*, 1 oz.

For want of a more appropriate name, some printers have termed it " Electroleum," which is perhaps more euphemistic than the names of the actual contents of the mixture. It should be kept in a closed vessel, as the " ether " is a very volatile body.

Another advantage of this " wrinkle " concoction is,

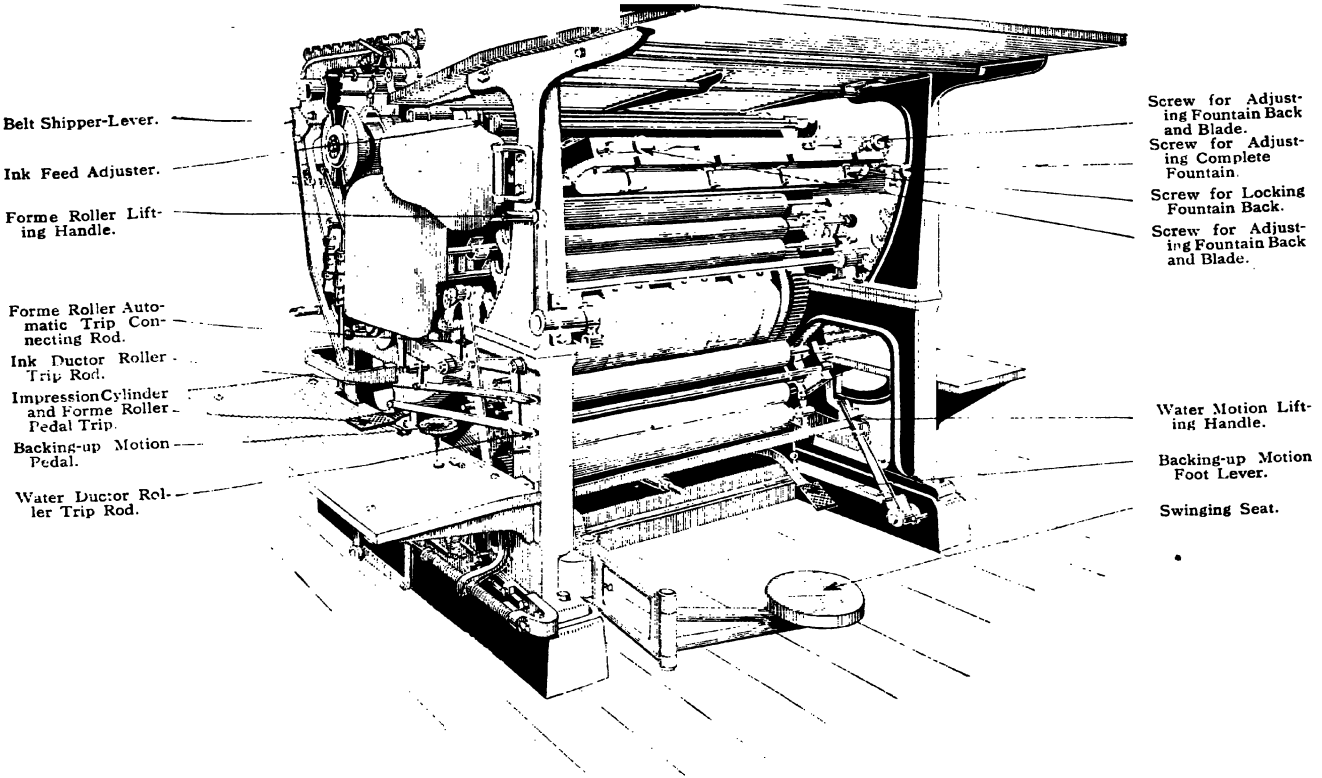


FIG. 37.—OFFSET LITHO. ROTARY PRESS (LINOTYPE & MACHINERY LTD.).

that it may be used in conjunction with "gold size" if desired, or other ink mediums; but its full efficacy is attained when used alone, as described above.

If properly mixed and utilised it will prove to be a very valuable adjunct to the press-room, and is one of the very best preparations so far devised for grappling with this ink problem for offset work, particularly where the manufactured colour is not of the best quality.

Although this has filled up the "gap," it does not claim to be a finality in this relation; there are many clever and thoughtful lithographers studying this ink question with deep intensity. When we remember how short a period it is since the advent of the rubber offset paper printing principle of lithography—apart from tin printing—we cannot but feel proud of the great progress already made by it in so short a time.

We have no hesitation in predicting that before the lapse of a similar period onward, that a very much greater advance will have been made, as the outcome of the earnest manner in which many enthusiasts of the trade are now directing their investigations and experiments to it.

CHAPTER XXV.

SOME OTHER METHODS OF INK PREPARATION FOR PLATE WORK—METHODS OF INTENSIFYING BLACKS—DITTO OTHER COLOURS—INK BINDERS—BRONZE AND METAL LEAF WORK—LACQUER INKS.

ANOTHER method of endeavouring to arrive at the same or similar results is to mollify the printing ink with an essential oil, and a mineral one.

For this purpose "lavender oil" and "paraffin oil" are employed in conjunction, the theory being that they perform the function of loosening the strong cohesion of the ink, rendering it *mobile* for working, without lowering its tinctorial power.

As both of these substances are *volatile oils*, they commence to evaporate spontaneously the moment they are fully exposed to the atmosphere. This enables the ink to partially recover itself by the time the impression is completed, but, of course, not so effectually as in the preceding method. Yet in comparison with a varnish reduction, a much more vigorous print can be made by means of this volatile oil method.

On the other hand, we have worked in lithographic establishments where old-style methods, such as were employed for "flat-bed reciprocating machines," are still being used in connection with inks for the rubber offset machine.

Many offset rotary minders use sperm oil and paraffin mixed for reducing their offset inks, just as is done for flat-bed machines.

One firm, which is quite content with the results attained, has its "black inks" mixed up for printing, with copal varnish, and boiled linseed oil, with a touch of "bronze blue" added.

In this latter connection, we prefer to add a small

quantity of Violet Lake to the black ink, as it produces a much richer, and deeper tone of block, than what the B. Blue does.

In these specified instances the improved sharpness and clearness of impression is considered to be sufficient compensation for the loss of density of colour in the print.

However, the proper policy is that which endeavours to obtain an all-round benefit in both quality, efficiency, and economy.

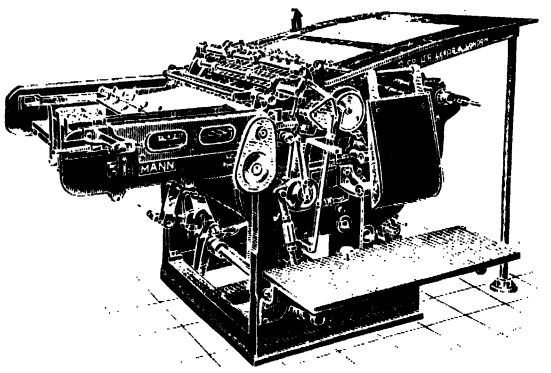


FIG. 38.—OFFSET ROTARY (GEORGE MANN & CO. LTD.).

Therefore the standard conditions that are sought to be maintained in this particular, are those, wherein every provision is made to retain the *fullest colouring power of the ink*, as well as the *utmost solidity of impression, and sharpness of print.*

This applies with equal force to all body colours. In the case of cheap blacks, some considerable amount of *extraneous intensification* and forcing of *tinctorial power* is oft-times possible by the judicious addition of a small proportion of "indigo blue," if thoroughly mixed up with the black. There are some hues of black in which "Prussian blue" (bronze blue) may with advantage be substituted for the indigo just

referred to, or of violet as previously described. Blacks possessing either of these additions work well from both zinc and aluminium plates.

But when we come to the "reds," "greens," "browns," "yellows," and some of the other "blues," such as "ultramarine" and "royal," then here we have not the same facilities or opportunities to fortify their strength of colour with additional or analogous pigments, as was the case with the black ink, as the purity of the particular original hue of the colour would be thereby debased.

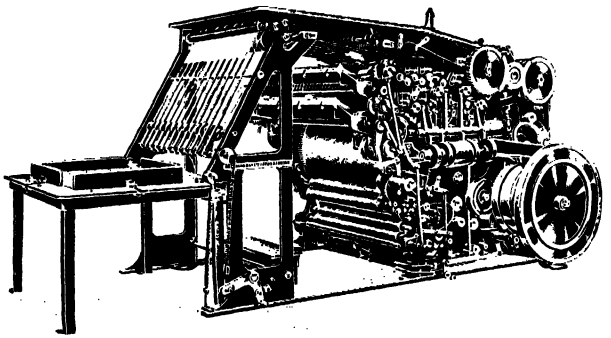


Fig. 39.—Two-colour Offset Rotary (George Mann & Co. Ltd.).

Again, the specific gravity and pasty nature of some of these colours demand exceptional treatment.

An alternative procedure, however, may be resorted to in connection with most of these other body colours, and that is, to endeavour to get the inks to take up more of their own *dry powder colour*, so that there will be a much larger proportion of pigment to vehicle used for incorporating it. By regrinding the whole at a more favourable speed, taking care that the heat generated by the grinding does not become too high, and making sure that the ground colour is absolutely free of grit, so as not to scratch the metal plate when printing, all that remains to be done then to complete

this intensification, is the colour being finally eased down for printing with the " Electroleum " mixture, or else with the " lavender " and " paraffin " oils, as described on preceding page.

For general rubber offset work, however, we do not recommend grinding one's own colours, as it is rarely, if ever, so well done, as when made by the expert ink manufacturer.

It is understood that the firmest consistency of the ink must be maintained, compatible with good printing qualities.

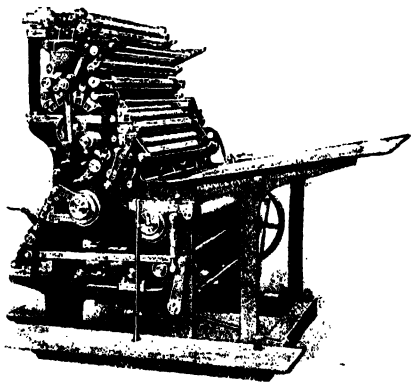


FIG. 40.—OFFSET ROTARY LITHO. (FURNIVAL & CO. LTD.).

It will not be forgotten that even these volatile ink reducants (beneficial as they are in comparison with the varnish reducants) disturb the power of colour somewhat; it therefore becomes imperative that we shall not add more of them than the exact amount requisite to procure mobility in the ink for printing purposes.

Under abnormal conditions of atmosphere and temperature, even the most perfect formula may run amuck, and if to this restriction we add the probable use at times of an inferior quality of colour, we may then be prepared to find that even inks mixed under carefully thought-out conditions as here indicated, may display under these circumstances some trouble in

working, and require supplementary treatment to obtain the best results from them.

This is one of the peculiarities of lithography and one which marks the dividing line between a mere mechanical craft, and one which is both mechanical, and chemical, combined with the physical side also; all of which may be summarised under the art-craft of lithographic mysteries.

It is here also that the technical, resourceful press minder comes out on top; he knows the cause and intelligently applies the remedy.

Taking one of the most prominent forms of these troubles—that of the "flecking," or separating out of the ink upon the plate in a myriad of minute particles, which, of course, become impressed in turn upon the printed sheets in the semblance of a broken tint. This defect is what is known by the names of "tinting" or "catching" in the workshop language of the trade in Great Britain.

The cause of this defect is a lack of *full cohesion* in the ink, brought about by the conditions enumerated in the preceding paragraphs.

The remedy is to re-establish a proper working equilibrium in the coherence of the ink.

To restore this balance of cohesion in the printing ink, binding substances must be added. These must, however, be introduced in a very precise manner, otherwise the ink may be made too viscid, as well as the colouring power being again weakened.

The most powerful binding substance for this purpose is the material termed "Diachylon." It must be compounded with beeswax and copal varnish in its preparation for this lithographic requirement.

Another excellent material for this purpose is Canada balsam. This latter, however, is a rather expensive chemical.

Venetian Tereb is another useful medium for this purpose.

The older remedy, as used under ordinary circumstances in lithographic printing, for "Flat-bed

machines," or "Direct Rotary" work, would be the use of either "strong," or "mid." varnish, added to the ink. This proves an unfailing remedy for this trouble, but then the strength of the colour suffers greatly by this treatment; in fact, for "rubber offset work" the reduction of the colouring power of the ink would become so palpable, as to give the print a washy, thin, flat appearance, besides imparting a stringy, mottled character to the "lift" of the ink in freeing itself from the metal plate to the rubber transfer blanket, and thence on to the printing paper.

In addition to the foregoing ink reducants, there is now a goodly number of proprietary ones, some made in transparent paste form for tints, and others as fluids for body colours.

The foregoing manipulative items are inherent craft difficulties which have to be thoughtfully negotiated by the lithographic printer, involving both expediency and craft skill which is peculiar to "metalithography" alone.

The lithographic ink manufacturers have also some responsibilities in this respect, particularly in regard to enhancing the *tinctorial power of lithographic printing inks* for "rubber offset work."

It is therefore gratifying to find that this particular ink problem, as applied to *commercial offset work*, is being assiduously grappled with by all the most prominent lithographic printing ink makers both in Europe and the United States.

Readers will note the successful British rotary offset ink makers among the advertisements at the end of this book.

The result already partially achieved is that a much better quality of black ink is now being marketed, which shows a most hopeful advance in covering power and opacity when compared with that which was produced in the earlier periods of rubber offset metalithography. Beyond this, a number of the most generally useful colours have also undergone reinforcement, and strength of hue, with the view of endowing them with an intenser depth, and vigour of colouration, suitable

for both "chromo" and "commercial rubber offset lithography."

Good "offset inks" cannot be procured as cheaply as the "direct" printing inks, but when it is remembered that they "go" nearly three times as far in printing, as what the others do, then it becomes cute policy to purchase good inks for this work.

Bronzes and Metal Leaf Work.—For this range of work we encounter quite a different set of conditions. On account of the "clingy" nature of the rubber blanket, it tends to detach the bronze powder from the sheet, so that the order of printing of the bronze is usually reversed wherever possible to a final printing, unless a special transparent printing is done over the bronze to encase it.

The considerations as to *opacity* are not material for "bronze" or "metal leaf" work. What we require here is *tenacity* of *pigment* or *vehicle*, so that they possess sufficient strength and drying capacity to securely hold the bronze powder firmly, and permanently to the sheet.

These bronze mediums may be semi-transparent, or may possess a hue similar to that of the "Dutch," or gold metal leaf, or of the metallic bronze powder that has to be dusted upon them.

It is not good policy to mix up a *dark umber shade* for printing a "pale gold" with. If the bronzing should be badly done in any part of the printing, then the dark pigment shows through the powder, and imparts a most discordant appearance to it.

Further, this pigment is apt to work sluggishly, and grittily; as well as to coagulate upon the rollers and ink slab. This accumulation of colour, or "caking" as it is here termed, is a very serious obstacle to flat and smooth printing.

We therefore recommend what we have found to be the very best medium for printing "bronze" or "metal leaf" work, and which all of those to whom we have recommended it have since declared to be the best that they have ever tried.

It consists of using a "lacquer ink," such as is used for producing the gold effects in *tin printing*.

These "lacquer" inks can be had in various shades of colour, such as deep orange gold, pale gold lacquer, etc., or mixtures of these may be made together to suit intermediate hues of bronze powder.

"Lacquer" inks are invariably excellent printers, and only require a small quantity of "copal varnish" to be added to them to break them down to working consistency.

If ordinary inks, however, should be used for the bronze printing work, instead of the "lacquer" ink, then good drying pigments such as "burnt sienna," or "burnt umber," and "flake white," with the addition of some "strong varnish"; and "beeswax" melted with some "copal varnish," and thin varnish, must be added, and well mixed in. Bronzing ink must be worked as stiff and viscid as what the printing paper will allow of.

In recent years great strides have been made towards the manufacture of an actual "bronze ink" which produces the *gold effect* without the necessity of having to use a bronze powder for dusting on. Such bronze inks are now in use, but are only employed for a very limited range of lithographic work.

In "direct" printing another trouble arising from bronze work upon metal plates is the scumming that is frequently caused by the bronze printing falling continuously upon the same portion of the plate, choking up the grain; so that repeated "washing-out" of the work and re-etching of the plate has to be resorted to, to prevent soiling of the sheets.

CHAPTER XXVI.

PRINCIPLES INVOLVED IN "DULL" AND "BRIGHT" COLOUR EFFECTS—INFLUENCE OF DRYERS—GLOSSY COMMERCIAL WORK—HELPFUL PALLIATIVES—GUM ADDITIVES TO INK.

In addition to the valuable list of reducants given in a previous chapter, others of a kindred nature as to drying or oxidising properties may be used, such, for instance, as Gold size, "Terebine," "boiled oil," etc., according to the nature of the printing paper that is being used, or the conditions of atmospheric temperature in which they are being employed.

Treatment to produce "Dull" and "Glossy" Colour Effects; and of Tints in Conjunction with Body Colours.—Now, whilst one definite set of conditions may be devised to cope with a particular range of requirements in metal plate printing, as just specified in the preceding example of work, there are at other times quite a different class, and range of productions to be undertaken, which will not permit of utilising those same methods of manipulation in their fulfilment.

For example, there are certain customers, as well as a goodly number of the heads of printing establishments, who especially prefer their printing being done, so that it shall display a *matt*, mellow appearance; in which a soft, dull, velvety texture predominates. Others, on the contrary, encourage and desire their printing to be done in such a manner that it will show a *glossy*, shiny finish, in which a distinctly glazed surface appearance prevails. So that we have here in these specified instances two entirely different sets of conditions imposed upon the printer.

Admitting, then, that both of these arbitrary and

contrary states of *dull* and *glossy* print effects have to be produced by a definite, and prescribed variation of treatment in the mode of mixing-up, and usage of the inks for printing, it follows that in order to give practical effect to these varied demands, that there must be employed two entirely different orders of materials in the compounding of these printing inks, in order to suit these particular demands, as one is necessarily the antithesis of the other in effect.

The technique of the underlying conditions which control this production of matt, soft, or anti-glossy print effect, is, that we employ only *non-drying oils* or *fatty substances* in all the inks which we require to dry with this dead surface, and carefully refrain from using any substances possessing a contrary disposition. Lard, tallow, sperm oil, and magnesia, produce the "matte" effects.

Proprietary medium such as "Herminol" added to the printing inks will also produce very fine matte results.

This, then, is entirely in the hands of the printer, as it is he who has to produce these effects by the technical manipulation of the printing inks.

Taking next the opposite method that must be employed to obtain the *glossy* or shiny print effect, we have in this instance to *reverse* our rule by here employing only the most powerful "drying oils" and "oxidising" substances that we can with safety incorporate in the ink, as it is by this means alone that the printing can be made to exhibit that special shiny feature which is the pronounced characteristic of the *glossy print*. Otherwise we should have to resort to the expensive and supplementary method of a second printing, wherein a specially prepared *glossy varnish tint* would have to be printed in dead register over the previous printing that comprised the actual work of the job. To do this, we should have to employ the plate from which the actual printing was done, in order to ensure absolute register and fit.

The substances needed in reducing the inks to pro-

duce the "glossy" prints are, Copal Varnish, Gold Size, Canada Balsam, Bleached Beeswax, Boiled Oil, or Terebine.

Fortunately, the demand for this class of glossy effect in lithographic printing from metal plates is the least prevalent of all the varied forms of peculiar printing demands, and at the same time, the least artistic in effect. Occasionally one encounters a merchant whose individuality prompts him to have his commercial lithographed stationery printed in a distinctive manner, such as in imitation of the "die-press, glossy prints."

We know of a firm of this character who insists most particularly in having all their "bill heads" and "invoices" printed in this glossy manner by lithography. When it is considered that part of this heading comprised a finely engraved view of their mill, which was also expected to exhibit a shiny appearance in the printing, it will convey some idea of the difficulties of the task.

One of the prominent troubles which the lithographic metal plate printer has to encounter when working for these glossy results is the setting off of the work, due to the ink having to dry upon the surface of the paper, being held there by the viscid varnish until the whole is hardened, through the absorption of oxygen from the atmosphere. Under other conditions, the lower layers of the ink would be absorbed by the paper, leaving a thin surface film only on top, to represent the printed matter.

This glossy printing necessitates the spreading out of the printed sheets singly upon light racks. To obtain the very best results the sheets should not be permitted to overlap.

"Slip sheeting," or "tissuing," as it is frequently termed, is another alternative, but there is always the threatened danger of the ink adhering to these interleaving sheets, unless very coarse, rough-surfaced stock is employed for this purpose.

Another point in connection with this latter procedure of "slip sheeting" is, that it is not a very easy

matter to accomplish in connection with fast-running rotary machines, due to the encumbrance of the automatic sheet delivery apparatus; unless a special, and expensive mechanical appliance is attached to the rotary press for this purpose of interleaving the printed work.

This lustrous attainment of the print is more difficult to accomplish by the offset methods than by the direct ones, on account of the thinner film of printed matter obtainable by rubber transfer procedure.

For the metalithographer the most formidable phase of this class of work lies in connection with the printing of this glossy state of colour from the susceptible zinc and aluminium plates, as, on account of the very active drying agents, and rapid oxidising bodies present in the ink to achieve this glossy effect, they generate reactions which are tiresome to keep in check.

In the first place, the dryers speedily cause an undue hardening of the ink with which the rollers and distributors are charged, which soon manifests trouble during the running of the press. It shows itself particularly prominent in its deleterious reaction upon the fine work of the job, causing deterioration of the print, wherever this fine work is located upon the plate.

In this respect, there is nothing more demoralising to the lithographic printer, than where he has to encounter these dire effects of a gradual weakening of the work upon the plate; and usually taking place concomitant with a scumming effect acting simultaneously, which makes it almost impossible to apply a satisfactory remedy in a direct manner.

This duality of trouble, embracing chemical and mechanical reactions, is the more vexatious, inasmuch as it has been brought about by circumstances under which he is compelled to act, in order to comply with the special demands of this particular work; and yet which, were the same job being done under the ordinary routine of everyday printing, would have spared him this particular worry.

It is quite a different matter when these inks are

being used mechanically only from engraved plates, as in " die-plate printing." Yet some firms are so exacting with the lithographer as to expect him to be able to imitate by his process every other form of the printer's art.

Helpful Palliatives.—It frequently happens that there are accommodating devices by which we can circumvent some cardinal part of these difficulties.

These may be regarded as " palliatives ; " so that the ill effects set up by the condition of things as depicted above, may be in large measure neutralised, or considerably overcome. We therefore submit a number of these for the benefit of those whose experience does not already include them, and we feel confident that many printers will find much that is both serviceable, and valuable in them, for the various different types of lithographic machines.

One such device for producing this *glossy colour effect* consists in mixing into the printing ink a small quantity of thick, syrupy, " gum arabic solution," and thoroughly incorporating the same throughout the bulk of the ink uniformly.

This article serves a double purpose : It helps on the one hand to keep the superfluous grease down upon the plate during working, by virtue of its " desensitising " properties ; whilst on the other hand it takes the place of the usual " oxidising oils " by imparting to the ink more active, spontaneous powers ; and also of introducing a more powerful glossing characteristic into the colour than is possible with the ordinary use of drying oils by themselves. The free moisture which it introduces into the colour soon evaporates upon exposure to a warm atmosphere.

In the instances where this gum method is used upon the " ordinary flat-bed reciprocating litho. press," it will be found to be a most easy and advantageous help, without any very troublesome drawbacks being attached to it.

Comparatively speaking, this gum addition to the printing ink induces it to dry *glossy*, with an even,

smooth shine, in a *quarter* of the time that the oil dryers would require to attain nearly the same result.

It enables the printing upon the flat-bed machine to be carried on less interruptedly, due to the aforementioned mollifying influences which its presence imparts to the water-moistened plate, and the counteracting restrictions which it exercises upon a very greasy printing ink.

Similar commendations may be bestowed upon this gum-laden ink when used upon the "ordinary rotary machine," always, however, restricting its use for short runs, or limited editions of moderately heavy work, where there is a fair quantity of ink required to feed the work.

In this respect the "rotary" and "flat-bed machines" are in the same category.

But for use in connection with the "rubber offset presses," the same utilities and recommendations cannot be as freely claimed for it, as has been applied to the other two types of power lithographic machines.

This variegation is due to the effect produced by the viscid moisture contained in the gum arabic syrup exercising a deleterious influence upon the susceptible rubber blanket, as some of the gum moisture from the ink accumulates upon the margins of the rubber immediately surrounding the occupied area impressed by the sheets during printing.

Another disqualification is the changed transferring qualities which this gum imposes upon the ink. This action is due to the gradual drying of a thin gum film, as it becomes separated out from the ink, and gradually accumulated upon the extreme margins of the rubber-faced blanket. Owing to the increased rotary speed of the impression cylinder upon these presses, as compared with the slow flat-bed presses, evaporation of this solution takes place here infinitely quicker. This defect is not confined to the rubber blanket alone, as a similar influence is exercised upon the extremities of the inking rollers.

Washing-up of the rollers at dinner-hour should be

resorted to upon the " flat-bed machines " whenever this " gum ink " is employed; and, of course, the same rule applies religiously to the stoppages each night.

Where this " gum ink " is being utilised solely for a single colour job, and one carrying large solid masses of ink free from fine lines, or delicate stipple, a robust gloss effect can be procured, and clearness of the metal plate maintained with comparative ease upon the flat-bed machine, or even upon the ordinary direct rotary machine, if run at a reduced speed, due to the aforesaid protective influences of this gum-impregnated ink.

Theoretically one would surmise that the gum would cause a wearing away, or deterioration of the job upon the plate. That is quite correct where the job that is being worked is of a very sparse character, and consequently calls for only a small quantity of ink to feed it. In this case the fatty metallic compounds become denuded and starved of their essentials, through absorption and extraction by friction and the printing paper combined. But where a liberal supply of colour is demanded, by virtue of the heaviness and fullness of the work upon the plate, these conditions amply protect the job from " working away " troubles, and deterioration; provided the length of the run should not be an immoderate one.

We may summarise, then, the ostensible benefits of this palliative as being synonymous with " single colour " and " heavy graded litho. work "; or for the " final printing upon a multicolour job," where these particular finishing effects of luminosity are desired.

But we must differentiate where later printings have to be made in succession upon it; or where the subsequent colours are in direct juxtaposition; as although no considerable part of this subsequent work might overlay this previous gum-colour printing, still the repeated effects of pressure and moisture combined (which would necessarily be imparted during these other workings) would materially degrade the original glossy printing, and leave a " marled " effect upon it.

CHAPTER XXVII.

SOME ESSENTIALS OF DECALCOMANIE WORK—LIMITATIONS OF METAL PLATE WORK IN CERAMIC LITHOGRAPHY—SOME LIABILITIES IN PLATE PRINTING METHODS.

It was for kindred reasons to those above enumerated that the ordinary rotary press had to be discarded for "decalcomanie" work, after some months of patient trial in Glasgow. Yet the same work in every variety of detail can be both commercially and economically produced from the ordinary *flat-bed reciprocating machine*, and has hitherto been so done unceasingly for considerably over twenty years in Great Britain, although chiefly by means of the lithographic stone, until this last few years, when zinc has been gradually getting a foothold in this industry.

The inks for this work must be of the best quality so as to withstand the heat after affixing to the metal article, and must be made to dry firmly. A special drying black is here used. Sparse and careful damping is also essential for this work.

We may remark in passing that there are *three* different branches of work in lithography, which have so far shown certain preference for stone, and have up to this time steadily combatted metalithography in a number of directions.

They are "decalcomanie printing"; "ceramic" or "pottery transfer printing"; and "iron enamel tablet printing," including the "powder colour" method.

During a number of years it was my privilege to demonstrate the advantages of metal plates for use in some portions of these various branches of lithography, and to instruct many artisans in the most perfect methods of working both zinc and aluminium plates for these special classes of work, in the chief centres of these industries in Great Britain.

In connection therewith, I am pleased to say that many of the old-time difficulties have now been removed, so that metalithography is fast usurping many of the more ancient "stoneographic" methods of the craft, even in portions of these abstruse divisions of the lithographic trade.

Metal plates are now generally used in the transfer departments of "ceramic" work; and also upon the machines for single colour work, or the first printings of a multicolour job.

The difficulty of using metal plates for the machine printing of this work is that the ceramic powder colours as printed upon the sheets soon cut away the surface of the metal during the printing of the subsequent colours of the job, just as they grind deep recesses in the stone, which is, however, thicker in capacity to allow for this.

In "decalcomanie work," although plates are used for printing the whole of the colours, it is difficult to do the "varnish size printing" for the final aluminium leaf work upon it from metal plates.

We are anxious that the young lithographic printer who is transferring his attention and labours from the *lithographic stone printing surface*, to that of the *metallic plate printing surface* in our craft, shall not labour under the impression that the metal plate—either zinc or aluminium—will enable him to leave behind him all the troubles and difficulties which assailed him when working with the stone.

Although such palpable troubles as "stone-breaking" and "vein-marking" will be left behind when he bids adieu to the Solenhofen polished slab, he will still have many of the old stone grievances with him when manipulating the metal-plate printing medium; while in addition he will have others which are peculiar to the plate-printing method alone.

The possible "crinkling" or "sagging" of the thin metal plate is one of these latter troubles unidentified with the much-abused, old-time, lithographic stone.

The "cracking" and "breaking off" of the bent

edge of the plate is another; while "scumming," "tinting," and "thickening" of the work *can* be done on plates, just as on stone, except where skilful and unrelaxing preliminary attention is bestowed by the pressman to avert this.

It may be laid down as an axiom of metal-plate lithography that the printer must display more "*nous*" and alacrity to attain good results in it than he ordinarily would do when working with litho. stone, as the plate prints at so much greater speed than is possible with the stone, which naturally calls for a speeding up of his energies and supervision.

At the same time we must not forget that modern metalithography is virtually in its childhood stage, and that it is safe to predict many important developments in the near future affording some relief to many of its troubles.

With these conceptions in our mind, we can concede every legitimate limitation of the respective mechanical appliances as at present evolved in the lithographic craft for metal-plate work; and yet, notwithstanding the prevalence of these restrictions in certain directions to-day, the experience of past developments teaches us the wisdom of keeping an open mind as to the ultimate removal of these various disabilities, and the almost certain possibilities of acquiring more potent powers of perfection in the immediate future. Such is the verified history of lithography all through its career.

CHAPTER XXVIII.

CROAKERS OF METAL PLATE PRINTING—EXTREMES OF LITHOGRAPHIC CRAFTSMEN—TRIUMPH OF PHOTO-PROCESS WORK IN METALITHOGRAPHY—EARLIER DAY FALSE PROPHETS—SIMULTANEOUS COLOUR PRINTING—LIST OF "DRYING" AND NON-DRYING INK REDUCERS.

An additional word of caution may be vouchsafed to the "tyro" of metal-plate work against being depressed by croakers who endeavour to disparage it, for those people have usually very little real, practical knowledge of its utilities, or manipulative experience of its working. So much depends upon the standpoint from which these matters are viewed. For example, a litho. printer who has been brought up at a small, unambitious establishment whose proprietor generally eschews everything new, acting upon the misguided policy that "That which is new cannot be true, and that which is true cannot be new." Such a craftsman is apt to detract and decry "metalithography," influenced, of course, by the narrowed "ken" from which he perceives it. On the other hand, the craftsman who has been brought up amid surroundings where encouragement was given to the most recent methods, and whose mind has been expanded by travel, and practical experience in other lands, and among other races of men, such a workman would chafe to introduce the latest and most advanced methods that his intelligence and experience had possessed him of. There is the contrast.

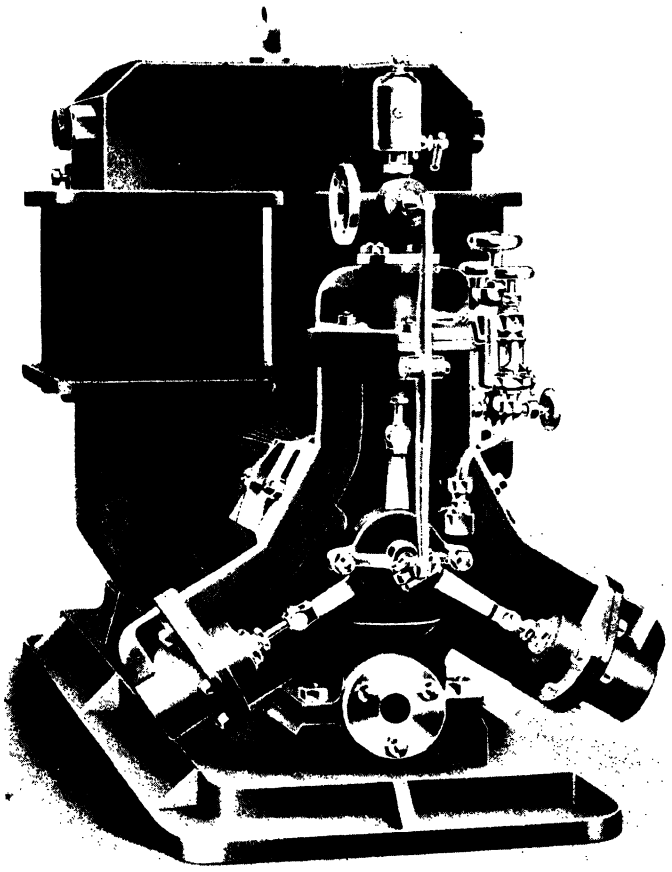
A striking instance of this "dog-in-the-manger" policy was revealed in connection with half-tone lithography. Some years ago we were assailed for daring to state that "half-tone screen image work" could be done by lithographers more true to pure tonal values, and possessing greater artistic effects, than could be

obtained by the half-tone relief methods of typographic printing.

A *soi-disant* scribe, who by the way had never been identified practically with photo-process work, animadverted upon this statement in the *British Printer*, and laboured up a rigmarole of imaginary, and academic difficulties opposed to this position, which he declared lithographers could never overcome, and which he blunderingly deceived himself had decolleted photo-process, ruled screen work in lithography, for all time. He was unaware of the fact, that, long before the ink was dry upon his proof sheets, we had ourselves accomplished a rough "high-light" method of doing this work; while others had attained still greater perfection which warranted their taking out letters patent for their "high-light half-tone lithography."

Some of the arguments then used against half-tone lithography were, "You cannot fine-etch half-tone work upon stone as they do in 'relief' half-tone block work in typography." These wiseacres did not apparently perceive that it was possible to obtain PURE HIGH-LIGHT TONES without the need of "fine-etching" methods at all; and that lithographers could use metal plates in lieu of the old-time lithographic stone. They had to be taught that their so-called high-light tones which needed so much "fine etching" to reduce the high-light tone dot to a tolerable size for printing in typography, represented superfluous tones to the lithographer, who had no need for them; and who improved upon this "fine-etching" method so magnificently, by getting rid of those false tones altogether—a far better method from every point of view than that of the typographic one, which necessitated this costly and skilful "fine-etching," and yet withal did not rid the false tones from the image.

And now to-day, there are a number of "high-light" methods in "half-tone lithography," both with *ruled screen* and *irregular grained screen work*, producing prints by rubber offset methods upon every class of paper—rough, matte, plain, or coated—which for



excellence, will vie with anything ever attained by the more pronouncedly mechanical type-block process of printing.

It would be difficult now to find anyone who would dispute the decided conquest which lithography has made over the lines of half-tone work which we have indicated above.

A similar reference applies to *simultaneous colour printing* in lithography. The ancient "great wisdomers" of the trade spurned the idea that two or more colours could be printed in pauseless succession by lithographic machinery, because, said they, "One wet colour would not lift upon another wet colour."

Yet simultaneous colour printing in lithography is now being done daily in England. Moreover, in every other country in Europe where lithography is a recognised industry the printing of wet colour upon wet colour is being carried on. In the United States the two-colour print was long ago done on the flat-bed reciprocating press, wet colour to wet colour.

Therefore, we have first of all to differentiate between what some consider to be possible, and what others know from actual experience is possible. Further, although we may be able to pick out a particular phase of lithographic work which is perhaps not being irreproachably done from metal plates upon a fast running rotary press at the present time, but which could perhaps be done from a slow-travelling flat-bed machine, it is fairly safe to predict that most of the difficulties which at the present moment cause this limitation will eventually be overcome, as the growth of their importance makes it worth while to enrol them among the other triumphs of metalithography.

In the mixing of the inks to suit the various other classes of lithographic plate work, in which quite divergent results have to be produced: such as is required for "window transparency prints," "posters," "textile fabrics," "show-cards," "decalcomanie," "photo process work," and "simultaneous muticolour printing," etc., it is quite obvious that many different con-

ditions and materials have to be introduced in the mixing of the inks, to afford the exact requirements of each different class of work produced. This is accomplished every day by such firms of trade printers as Messrs. Taylor Bros., of Leeds.

It is therefore imperative that the metalithographic printer shall become conversant with the exact properties of the various ink auxiliaries used, such as oils, fats, varnishes, dryers, reducing mediums, powders, etc., and likewise the different forms of drying by evaporation, oxidation, and saturation.

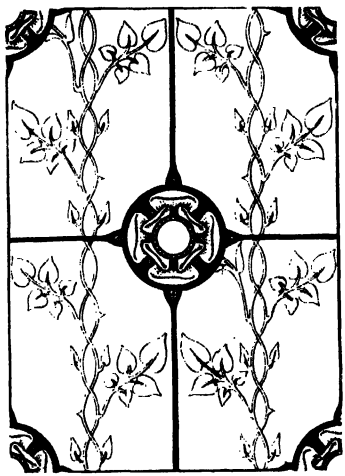
He should learn also that certain dryers contain within their composition definite chemical elements that possess an affinity for each other when mixed; and that should two such different dryers be added together in an ink, there would be the risk of decomposition and exchange of substances, in which non-drying substances might be produced: for instance, lead acetate and zinc sulphate could react upon each other and produce lead sulphate ($Pb\ SO_4$) and other non-drying compounds.

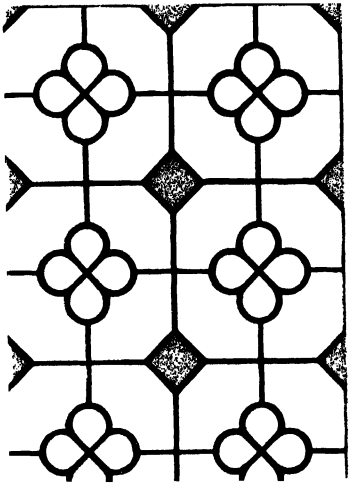
A too liberal addition of dryers to an ink is not beneficial, as it produces a superficial skin on the colour.

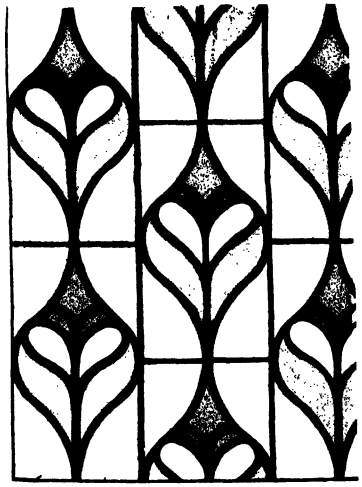
It should not be difficult for the earnest metalithographic printer to clearly master this sharp, and clearly defined line of demarcation between these groups of ink mediums and reducants, in order that no mistake should occur in mixing opposing ink elements in the one and same ink, through the lack of proper technical knowledge, as these antagonistic properties would counteract and retard each other's influence. We arrange herewith a short list of each group for reference by the young metal plate printer:—

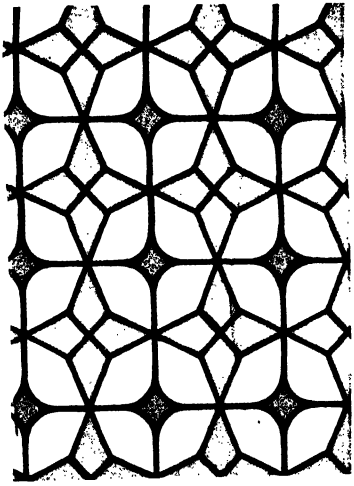
Non-drying or Absorption Group.

Tallow,	Paraffin,
Lard,	Starch,
Sperm oil,	Oleic acid oil,
Thin varnish,	Corn flour,
Olive oil,	Transparent alumina,
Raw linseed oil,	Castor oil,
Chinese wood oil,	Magnesia.









"ZENITH" TRANSPARENCY DESIGNS (REDUCED).

"Drying" or "Glossing" Substances.

Copal varnish,	Manganese borate,
Gold size,	Canada balsam,
Siccatif de Paris,	Gum arabic,
Terebine,	Balsam fir,
Boiled linseed oil,	Lead acetate,
Litharge,	Venetian terb.,
Sulphate of zinc.	Poppy oil.

(*Note.*—Any of the chemicals required for metalithography can be obtained from Messrs. Griffin's, Kingsway, London, W.C.)

In addition to this list of general substances, there are many proprietary ones, such as York Driers, Herminol, Stolithol, Phœnix Paste, etc., which are specially made to meet the requirements that the above groups cater for, and which find favour with a fair *clientele* of metal plate printers. A demur is raised by some anent these manufactured products that they may contain deleterious ingredients which may possibly injure the rubber blanket; but many of these proprietary substances have successfully been used in connection with tin decoration—printing on tin by lithography—by the tin printer, who depends upon the rubber blanket offset print for the fundamental basis of his work, just as is the case with the offset paper printer.

RUBBER BLANKET POINTERS—OFFSET MACHINE MANAGEMENT—SOME SPECIAL OFFSET PAPERS.

THE rubber blanket process seems to present difficulties peculiar to itself owing to unexplainable variations of the quality and durability of the auxiliary materials used. One has only to take the blanket as an example. Here the careful rubber offset press minder confers the greatest attention and efforts to preserve his rubber blanket in the best possible condition, as so much of the success of his work depends absolutely upon this prevailing condition.

By neglect, or faulty treatment, this article soon deteriorates.

Even with the best of care, this perverse material sometimes goes wrong, whether of the dark rubber kind or the red one. "Blistering," "unevenness," or "flabbiness" are amongst the worst drawbacks that befall it.

These are some of the prominent reasons which makes the printer loath to add anything to his printing inks of a problematical nature—that which might produce any form of deterioration in this costly and important material.

There is such a peculiar untractableness of stamina in connection with the working life of this article, that it becomes much of a lottery when a new blanket is attached to the press cylinder whether it will have a long life, or a short one.

As a safeguard against any of these defects that may reveal themselves at one time or another with different rubber blankets, it becomes an absolute necessity that the machine minder shall be posted in the fullest

technical information regarding the best treatment to be assigned them, so as to stave off as many of these idiosyncrasies as long as possible; or to apply the best remedial treatment to cope with each contingency.

In pursuance of this precept and caution, we here submit some important information and valuable pointers learned direct at the establishments of some of the best manufacturers of this notable article of rubber covering in the British Isles.

A general insight into the process by which these rubber blankets are manufactured will help to give a better grasp of the subsequent treatment and care of them in everyday work at the power press.

The most popular form of these blankets as used for tin printing, and rubber offset printing upon paper and textile fabrics, are those known as the three-ply kind. A five-ply is also made for special types of work, and special conditions of machines.

Tersely put, they are comprised of three alternating layers of specially woven and stretched fabric, interspersed with three uniform layers of rubber film.

This cloth, before being rendered fit for use for blanket making, has to undergo special rolling, and stretching operations, after the most careful weaving.

Not only is this stretching done in one direction, which might correspond with the " warp " run of the fabric—the lengthwise yarn of the cloth—but is just as severely done the " weft " way of it also.

This is repeated, and the stretch noted each time, until no appreciable expansion is apparent.

It sometimes happens that at one time a much more pronounced stretch is revealed in one direction than the other; yet, as a peculiar set-off to this, the opposite direction may on another occasion yield the greater expansion. All these peculiarities it is the business of the rubber blanket manufacturer to gauge, and rectify as much as possible, or the conditions of the materials will allow of.

The textile fabric that is used in the manufacture of these blankets is carefully scrutinised before treatment

by weaving experts, and equally so, after it has undergone the treatment of maturing for blanket making, by the manufacturer's experts.

When the first ply of fabric is laid down as the base of the blanket, it receives the first application of rubber solution. This coating has to undergo a prolonged and continuous treatment of "curing," pressure and heat being the dominant factors here. It is not a single layer of rubber solution that each ply receives either, but a number of additional coatings succeeding each other, and each cured in turn until the ply receives the arbitrary thickness assigned to it.

Then comes the next ply of fabric, and the amalgamating, and repeated curing processes as before, until all the plies are completed, and the final surfacing finish is reached.

As rubber can be prepared in various grades of hardness, it follows that it has to undergo special treatment to attain those varied conditions. This is represented by the "vulcanising," in which it is treated with sulphur.

A special state of resiliency is sought to be maintained in the lithographic rubber blankets of commerce, and an imperviousness to rapid perishing of the material endeavoured to be reached.

Now, as these standards of manufacture have to be arrived at through definite, and inviolable conditions, so far inseparable from the regular routine of manufacture, it becomes imperative that the subsequent practical treatment meted out to these blankets during work must be in strict conformity with their basic nature, or else deterioration in their condition will ensue.

Consequently, all substances which exercise a deterrent influence upon the rubber fabric must be eschewed entirely, and only those substances employed for cleaning purposes which have no solvent effects upon this rubber material; they must be merely absorbers of ink or fatty substances.

There are, of course, some fluids which are grease

absorbers alone, and others which not only absorb grease, but also digest rubber as well.

Such substances as benzole or benzine, although they will effectually remove greasy ink, also dissolve rubber; consequently such a fluid should not be used for cleansing purposes on rubber blankets.

Paraffin, although hitherto extensively used, leaves a greasy tinge behind it, and it is not the ideal rubber cleanser.

One of the most perfect cleansers as referred to previously in connection with rubber rollers is the "Ipswich Rubber Wash"; failing that, then we advise the use of coal tar naphtha in a fresh rectified state. It should, however, be fresh and not stale. It is by far the most perfect and harmless of the oil fluids.

These fluids have the least injurious effect upon the rubber of any cleansers that have hitherto been employed.

After the washing has been effected, the rubber blanket should be dabbed all over with "French chalk." The best way to do this is to make up a wad of flannel, or a flannel bag filled with this talc, and it is then dabbed on all over the blanket surface. Finally, smooth all over with a clean, soft piece of linen, or a first dusting over with "flour of sulphur," and then "chalk," helps to keep the blanket in good condition, or it may be dusted over with a mixture of these two substances.

If a flabby, or spongy, or blistering part should develop upon a blanket, it is almost impossible to correct it by any mere surface treatment with sulphur. The cause and depth of the trouble is much too deep for that.

When a good cleanser is used there is no need to run through such a large pile of waste sheets to get the rubber to pick up the ink evenly after washing.

Sometimes a troublesome little puncture occurs in a blanket and impairs the work being printed. The best remedy to fill in this hole with is Prout's "elastic

glue." This must be inserted with the aid of a warm knife, exercising the greatest care in the manipulation, of course.

Hard ink may be judiciously removed from the rubber blanket, by means of a piece of "cuttle-fish bone."

Where a rubber blanket has become very "sticky" it may frequently be restored by rubbing over it some "carbon bisulphide" applied with a soft rag.

The sulphur re-hardens the surface, producing a partial revulcanisation.

Sometimes after a few hours printing the colour begins to lose its density; this is invariably due to the blanket getting out of condition; frequently the ink reducants are much to blame for this, at other times the addition of foreign substances to the damping water contribute to this state, or an excess of water will produce it also. We have at times corrected this trouble by occasionally throwing off the dampers for a couple of revolutions of the cylinders, without interrupting the printing.

Special papers are now being manufactured for offset work, which yield unique results. One of these is the special deckle-edged paper known as Basingwerk Parchment, supplied by Messrs. Grosvenor, Chater & Co., London. A specimen print upon this paper is included in this book. Messrs. R. J. Tanner & Co. Ltd., supply another class; the Hopsack, upon which another specimen is printed. Messrs. Dickinson also show a supplement done on their Cordelia.

In rubber offset printing it is advisable to work with pure water in the trough, and not to add "concoctions" to it, as is so frequently done upon other types of lithographic printing machines.

The brass damper rider should be frequently washed clean with turps, to remove any of the ink accumulations upon it.

If the job that is being printed is not a very light one, do not depend upon the "knife feed" for ink supply, but set the ink ductor cylinder to work with a single

notch movement for each print : this will give safer and more uniform printing results.

If " indents " or " mounds " have been caused upon the plate through small paper pellets, etc., these raised portions cause " scumming," and should be judiciously levelled down by laying a piece of thin cardboard over the faulty part and gently tapping over it with the rounded side of a small " spanner." It should then be re-etched and gummed.

CHAPTER XXX

THE HAYES UNIVERSAL TUBULAR PROCESS—CONTINUOUS LITHOGRAPHIC PRINTING FROM THE REEL—CALICO PRINTING IN COLOURS BY LITHOGRAPHY—TUBULAR METALITHOGRAPHY — SIMULTANEOUS MULTICOLOUR PRINTING—APPLICATION TO PAPER INDUSTRY.

"TUBULAR" metalithography, or "all-rotary lithographic printing" from complete metallic cylinders upon continuous rolls of textile fabric or rolls of paper by the latest patented English process is the subject of this chapter. Hitherto, in the preceding chapters, we have confined ourselves to metalithographic printing from cut sheets of metal, either zinc or aluminium plates, where only single, separate sheets of paper can be employed for printing upon, and not uncut paper in the roll. This is equally true whether a rotary machine is used, or any of the older types of power machines, such as the reciprocating flat-bed machines of earlier date.

Therefore it will be at once recognised that only a *segment* or portion of the printing cylinder can be employed at each of its revolutions for actual printing purposes, leaving, as a matter of fact, at least one-half of this printing cylinder unengaged in actual printing capacity; and consequently there is, to that specified extent, a definite loss of utility in that type of press.

It follows then, as a natural sequence, that if a lithographic printing machine could be so devised as to enable an undivided metallic tube of either zinc or aluminium to be employed for printing from, then the *entire periphery* of it could be unrestrictedly utilised for continuous, pauseless, printing purposes, instead of being limited to a mere third, or half of the cylinder periphery, as in the older orthodox methods.

From this it is at once apparent that the printing capacity of such a machine is at least doubled, or in some cases trebled, compared to the ordinary rotary. Stating the case figuratively, it results in the "making of two blades of grass grow where one only grew before."

Another revolutionary feature in connection with this "all-rotary machine" is its duplicated attachment fittings, which enable change of colours, and of job

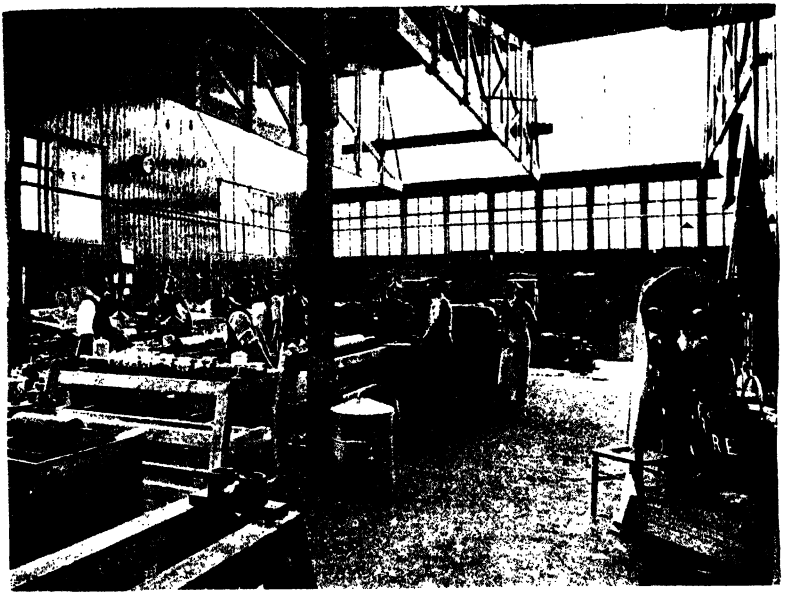


FIG. 41.—ALL ROTARY TRANSFER DEPARTMENT.

to be made ready in a few minutes' time, and the printing proceeded with for the next order in that expeditious manner. This itself is a vast improvement on the existing order of things, as it utilises a detachable "trolley" arrangement, operated away from the machine for the purpose of making ready the next succeeding job and colours, whilst the previous job is still being printed in the machine.

When ready this duplicate mechanism with job attached is slid into position in the machine as soon as the other duplication containing the old job is withdrawn.

It will no doubt be of absorbing interest to all branches of the litho. craft to know that such a result has actually been obtained, after a long chain of evolutionary developments, and the expenditure of over two hundred and fifty thousand dollars to accomplish; and that the result is a practical working method now

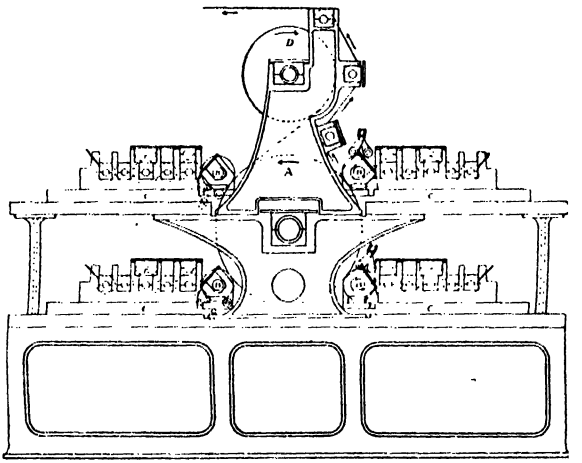


Fig. 42.

having been in constant productive operation for over two years in the printing of textile fabrics.

The following diagram will convey a rough idea of the principle of the machine.

The large cylinder (A) represents the impression cylinder, around which travels the roll of cloth, or the roll of paper that has to be printed upon. (B) represents the printing tubes. (C) indicates the tray arrangement referred to, while (D) shows the reel of fabric in position being fed into the machine; the arrows indicate its delivery after printing.

The printing surface is a zinc or aluminium tube.

The design to be printed is transferred upon this by means of a special transfer press so that the whole surface circumference of it is utilised, and thus the image is reproduced at definitely continuous repeats, all along the roll of material, no matter how long it may be. And particularly in the case of fabrics, and what is of the utmost significance is, that the printing is done with *lithographic oil colours, permanent to light and durable to washing.* This is an immense advantage over the fugitive aniline gum colours of the orthodox calico printer.

The ink-feed, distribution and supply to the printing roller is done in a direct manner, the distributers feeding the inker and this in its turn the printing cylinder. In order to admit of the most varied and articulate flow of colour to suit all classes of work, the ink ductor box is constructed upon the novel plan of sectional partitions. This idea is covered by a special patent.

The inking roller, ductor and printing tube are all attached upon a combined sliding tray device, so that they all can be brought into simultaneous printing operation instantly.

The pressure is regulated by a graduated lever attachment, and contact can be made or broken instantly whilst the press continues running, or it may be stopped just as quickly.

The "cloth" or "paper" is fed into the machine from a convenient position, and passes over the machine after printing on to the winding spindle, being adequately protected with an interleaving blanket to prevent set-off or smearing. In the case of paper an automatic cutting device severs the prearranged size of sheets. The speed of the press is easily eight times as fast as that of the flat-bed type.

The foregoing reference has so far only applied to single colour work, but the presses are built to print four or more colours simultaneously, two trays being arranged in front of the cylinder and the other two behind it, each tray printing in succession its particular colour complement of the job in hand. The material

thus enters the press at one side in a virgin state and emerges at the other side a completed design, printed in four different colours, affording an infinite variety of hues in response to the superposition and juxtaposition of these four colours. By using the "photo tri-colour selection" process in the preparation of the printing image, the ordinary reproduction of a multi-colour picture in three workings can be obtained, or a fourth colour can be included to enhance effects.

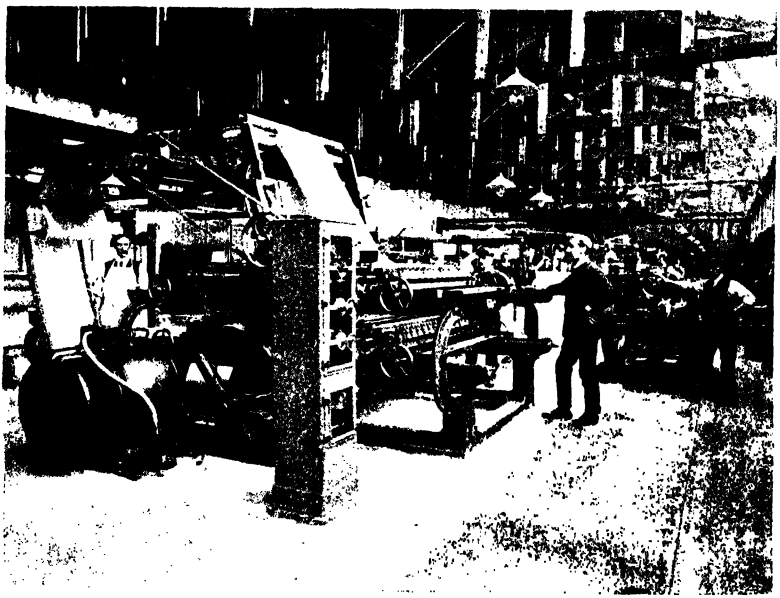


Fig. 43.—View of Machine Room.

So far these machines have only been industrially employed for textile fabric printing, known generally as calico printing, a very large English industry, the name being derived from Calicut, in India, from whence the white unprinted cotton was originally imported.

In point of emphasis, however, this all-rotary tubular machine prints lithographically upon every form of textile fabric, including silk, satin, velvet, linen, and chiffon, materials some of which baffled the old-time calico printer.

Thus lithography is, by the aid of this new invention, now ushered right into the domain of another industry, extending its sphere into new realms of employment, enlarging its capacity for wider industrial service, besides enriching the fabric printing process up to the level of lithographic attainments.

It is perhaps appropriate, in the natural order of things, that this process should have been invented in the very citadel of the calico printing industry by a Manchester merchant, Mr. John Jefferson Hayes, who many years before had been identified with an effort to adapt a flat-bed litho. machine to this work, but that method proved to be too costly to be of commercial value. About five years ago, however, he evolved the germ of the present process, upon which he has since devoted his whole energies in perfecting it to its present state. A large factory was erected in 1911 at the First Garden City, Letchworth, Herts, where a full complement of this new plant has been devoted to carry on the work of calico printing by this new process, large volumes of textile material being daily printed and subsequently shipped to all parts of the world.

The great point, however, that should be recognised is that this new lithographic method is capable of being applied to other materials than textiles, and that arrangements are already contemplated for developing the application of it to paper, where the field is extensive and comprehensive enough to include wall-paper printing in oil colours, consequently upon a more permanent hygienic and higher artistic order than the method at present in vogue.

"Four-colour illustrated newspapers" and "magazines" are another open sphere for its exploitation. "Posters," "labels," "paper box work," "bottle ovals," picture postcards, wall-papers, and a shoal of other work of this nature lie within its province. Then there are "linoleum printing," "oilcloth work," and other materials, such as "fancy leather," "felting," etc., which have yet to be negotiated.

As an indication of the importance of this sheetless

lithographic process, patent rights have been granted it in practically every commercial country of the world, including the United States of America, Great Britain, and Germany.

The *rubber offset method* of printing can also be laid under tribute to this all-rotary process, as are also many other phases of our " premier pictorial art, depictive of all the arts " ; so that it is not only powerful in attained results and effect, but is capable of greater development and accomplishments in the near future.

A typical example of latice printing done by this process is included in this book.

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